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LOCHSTREIFENLESER PTR 100
LOCHSTREIFENLESER PTR 101
LOCHSTREIFENSTANZER PTP 100

Informations Systeme

GE 115

BULL
GENERAL ELECTRIC

Ref.-Nr.: 32.22.401 D 1

GE - 115

Lochstreifenleser	PTR 100
Lochstreifenleser	PTR 101
Lochstreifenstanzer	PTP 100

Neubearbeitung

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Kapitel A

Lochstreifenleser PTR 100 für Lochstreifen mit runden Lochungen

1. Allgemeine Beschreibung

1.1. Aufgabe und Aufbau des Lochstreifenlesers

Der Lochstreifenleser PTR 100 liest Lochstreifen mit runden Lochungen und hat eine Lesegeschwindigkeit von 500 Zeichen in der Sekunde. Der PTR 100 besteht aus folgenden Hauptteilen:

- Transportvorrichtung für den Lochstreifen
- Bedienungspult
- Elektronische Einheit bestehend aus: fotoelektrischen Zellen, Verstärker für Leseimpulse, Ein/Ausschalter (ON/OFF)
- Verbindungseinheit, um die Randeinheit an den Rechner anzuschließen.

1.2. Interface

Die Randeinheit wird an den GE-115 über ein Standard-Interface angeschlossen.

2. Datenträger

2.1. Eigenschaften des Lochstreifens

Als Datenträger dient ein Lochstreifen mit einer Breite von 1 Zoll oder 11/16 Zoll. Der Lochdurchmesser beträgt 7/100 Zoll. Der Lochstreifen ist auf Spulen aufgewickelt, deren Durchmesser 8 Zoll beträgt. Transportrollen bewegen den Lochstreifen. Die ECMA Normen der Lochstreifen führen die Toleranzen auf, die für Lochstreifen zulässig sind.

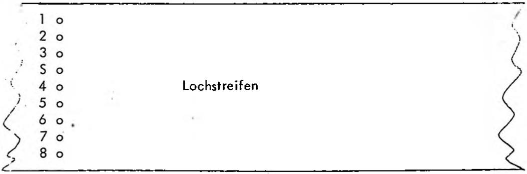
2.2. Arten der Lochstreifen

2.2.1. Bezeichnung der Kanäle

Es gibt Lochstreifen mit unterschiedlichen Kanälen, und zwar:

- 5 Kanälen
- 7 Kanälen
- 8 Kanälen

Außerdem ist es möglich, den einzelnen Kanälen über einen Schalter eine unterschiedliche Wertigkeit zuzuweisen und damit den jeweiligen Code festzulegen. Die Kanäle werden folgendermaßen auf dem Lochstreifen angeordnet und bezeichnet:



S bedeutet hierin: Transportlochung

2.2.2. Schalter in Stellung A

Der Lochstreifenleser liest 8-Kanal-Lochstreifen mit einem Paarigkeitsbit, wenn der Schalter auf die Position A eingestellt ist. Der Code ISO 7 + 1 ist z.B. ein 7-Bit-Code plus Paarigkeitsbit, wobei die Bits folgende Kanäle belegen:

Bit	Kanal
a	1
b	2
c	3
d	4
e	5
f	6
g	7
h	8

Das Bit a hat die niedrigste Wertigkeit ($2^0 = 1$); Bit g die höchste Wertigkeit ($2^6 = 64$). Bit h stellt das Paarigkeitsbit dar. Das Umschlüsseln von 7 auf 8 Bits geschieht auf folgende Weise:

$$\begin{tikzcd}
\text{Gelesene Bits:} & & 7 \arrow[dl] \arrow[dr] & 6 \arrow[dl] & 5 & 4 & 3 & 2 & 1 \\
\text{Endgültiges Zeichen:} & 7 & 6 & 7 & 5 & 4 & 3 & 2 & 1
\end{tikzcd}$$

Der Lochstreifenleser ignoriert die Zeichen "11111S111" und "00000S000". Die bisherige Paarigkeitskontrolle für 7-Bit-Zeichen wird auf eine Kontrolle auf Unpaarigkeit für 8-Bit-Zeichen umgestellt.

2.2.3. Schalter in Stellung B

Der Lochstreifenleser liest 8-Kanal-Lochstreifen mit einem Unpaarigkeitsbit, wenn der Schalter auf die Position B eingestellt ist. IBM und Friden setzen z.B. diesen Lochcode ein, bei dem die Kanäle folgendermaßen bezeichnet sind:

Bit	Kanal
a	1
b	2
c	3
d	4
h	5
e	6
f	7
g	8

Das Bit a hat die niedrigste Wertigkeit ($2^0 = 1$); Bit g die höchste Wertigkeit ($2^6 = 64$). Bit h stellt das Unpaarigkeitsbit dar. Das Umschlüsseln von 7 auf 8 Bit geschieht wie folgt:

Gelesene Bits:	7 6 5 4 3 2 1
Endgültiges Zeichen:	7 6 7 5 4 3 2 1

Der Lochstreifenleser ignoriert das Zeichen "01111S111".

2.2.4. Schalter in Stellung C

Der Lochstreifenleser liest entweder Lochstreifen mit 5 Kanälen ohne Paarigkeitsprüfung (Fernschreibercode) oder Lochstreifen mit 7 Kanälen und einem Unpaarigkeitsbit (Code ISO 6 ÷ 1).

Zum Lesen der Fernschreibbänder muß ein besonderer Leser mit einem entsprechenden Lesekopf verwendet werden.

Das Umrüsten eines normalen Lesers auf das Lesen von Fernschreibbändern dauert einen halben Tag.

Es werden folgende Kanäle belegt:

Bit	Kanal	
a	1 - 5	
b	2 - 4	
c	3 - 3	
d	4 - 2	
e	5 - 1	
f	6 -	für Fernschreiber immer null
g	7 -	
h	für Fernschreiber immer null.	

Das Bit a hat die niedrigste Wertigkeit; Bit f ist das Bit mit der höchsten Wertigkeit. h stellt das Unpaarigkeitsbit dar. Beim Lochstreifen für Fernschreiber, der nur 5 Kanäle aufweist, werden die Bits f und h immer als Null angesehen.

Der Lochcode ISO 6 ÷ 1 belegt jedesmal das Paarigkeitsbit aufgrund der jeweiligen Bit-Anordnung. Da der Lochstreifen für Fernschreiber ohne Paarigkeitsbit arbeitet, kann es vorkommen, daß der Leser auch Daten mit falschen Paarigkeitsbits überträgt. Das Umschlüsseln von 6-Bit-Zeichen auf 8-Bit-Zeichen geschieht folgendermaßen:

$$\begin{tikzcd}
\text{Gelsene Bits:} & & & 6 \arrow[dll] \arrow[dl] \arrow[d] & 5 & 4 & 3 & 2 & 1 \\
\text{Endgültiges Zeichen:} & 6 & 6 & 6 & 5 & 4 & 3 & 2 & 1
\end{tikzcd}$$

Der Lochstreifenleser ignoriert beim Code ISO 6 + 1 die Zeichen "1111S111" und "0100S000".

3. Beschreibung des Lochstreifenlesers

3.1. Zufuhr des Lochstreifens

Die mechanische Vorrichtung zur Aufnahme und zum Transport des Lochstreifens besteht aus:

- 2 Spulen
- 2 Spannarmen
- 2 Andruckrollen

Jede Spule hat einen Kontakt, um das Ende des Lochstreifens beim Vorwärts- oder Rückwärtslesen anzuzeigen.

Bei Abgabe dieser Signale muß die Bewegung des Lochstreifens sofort unterbrochen werden.

Der Lochstreifen wird durch einen Reibungseffekt straff auf der Spule gehalten. Der Reibungseffekt wird durch den Kontakt "Ende des Lochstreifens" in der Mitte der Spule erzeugt.

Mit diesem System kann die Bewegungsrichtung des Lochstreifens ohne manuellen Eingriff umgekehrt werden.

3.2. Lesekopf

Der Lesekopf befindet sich zwischen den beiden Andruckrollen und besteht aus:

- Nebeneinander angeordneten Fotozellen
- Einer Lichtquelle
- Einer Linse, um die Lichtstrahlen zu bündeln
- Einer mechanischen Vorrichtung zum Ausrichten der Lichtquelle, der Linse und der Fotozellen. Mit dieser Vorrichtung wird der Abstand zwischen dem Lochstreifen und dem Führungsblech auf ein Minimum eingestellt.

3.3. Geschwindigkeiten

Durch einen Schalter können drei verschiedene Transportgeschwindigkeiten des Lochstreifens eingestellt werden:

- Langsam:
  250 Zeichen oder 0,635 m/sec
- Normal:
  500 Zeichen oder 1,270 m/sec.
- Schnell
  Zum manuellen Rückspulen mit 775 Zeichen oder 1,970 m/sec.

3.4. Mikroschalter zum Testen der Fehler

Zwei Mikroschalter zeigen folgende Fehler an:

- Der Spulendeckel ist nicht richtig geschlossen.
- Der Schalter für die Lesegeschwindigkeit ist nicht richtig eingestellt und steht nicht auf 500 Zeichen pro Sekunde.

4. Operator-Pult

4.1. Leuchtanzeigen

OFF	- Die Einheit ist ausgeschaltet. - Die Anzeige leuchtet auf, wenn die Taste OFF gedrückt worden ist.
ON-STOP	- Die Netzspannung ist eingeschaltet. - Die Anzeige leuchtet auf, wenn der Lochstreifenleser eingeschaltet wird.
OPERATE	- Die Anzeige leuchtet auf, wenn der Leser im Modus on-line arbeitet. - Der Leser kann nicht vom Pult aus gesteuert werden.
ALERT	- Die Anzeige leuchtet auf, wenn eine der Bedingungen "Außer Betrieb"vorliegt.
TAPE END START ←——	- Die Anzeige erlischt, wenn die Bedingungen beseitigt worden sind. - Die linke Seite der Anzeige bedeutet "Ende des Lochstreifens". - Die rechte Seite der Anzeige ist bei Vorwärtsbewegung des Lochstreifens sowohl bei OPERATE als auch bei manueller Betätigung erleuchtet.
TAPE END START ——←—	- Die Anzeige entspricht der Bewegungsrichtung des Lochstreifens (siehe ←——).

4.2. Drucktasten

OFF	- Durch Drücken dieser Taste wird die Spannung abgeschaltet. - Die Anzeige OFF bleibt erleuchtet.
ON STOP	- Die Taste dient zum Einschalten der Spannung. - Durch Drücken der Taste wird der Leser auf manuell geschaltet.
STOP	- Durch Drücken dieser Taste wird die Zufuhr des Lochstreifens manuell unterbrochen.
OPERATE	- Durch Drücken der Taste wird der Leser auf OPERATE geschaltet und die entsprechende Anzeige leuchtet auf. - Die Taste bewirkt das Löschen der Bedingungen, die den Leser auf manuell geschaltet haben, sowie das Löschen des Signales "Leser belegt" (nach einem Übergang in den manuellen Status).
TAPE END START ←	- Befindet sich der Leser im manuellen Status, so bewirkt diese Taste den Weiterlauf des Lochstreifens bis die Taste ON STOP gedrückt oder "Ende des Lochstreifens" festgestellt wird.
TAPE END START →	- Entspricht der Bewegungsrichtung des Lochstreifens (siehe ←).

SWITCH	- Schalter mit drei Stellungen folgender Bedeutung: - Stellung A für Lochstreifen mit 8 Kanälen und Paarigkeitskontrolle. - Stellung B für Lochstreifen mit 8 Kanälen und Kontrolle auf Unpaarigkeit. - Stellung C für Lochstreifen . ISO 6 + 1 oder . Fernschreiber (ohne Paarigkeitskontrolle).

5. Prüfen der logischen Funktionen

5.1. Zustand des Lesers

Der Befehl auf Vorschub des Lochstreifens wird nicht angenommen, wenn kein Lochstreifen vorhanden oder der Spulendeckel nicht geschlossen ist.

5.2. Vorschub des Lochstreifens

Das Signal "Ende des Lochstreifens" macht die Befehle für die Lochstreifen, bis auf die Befehle zur Umkehrung der Bewegungsrichtung, unwirksam.

6. Lochstreifenleser

6.1. Einlesen eines Zeichens in den Kernspeicher

Der Leser hat einen Pufferspeicher für 8 Bits. Die Bits vom Signalverstärker werden im Puffer gespeichert, wenn ein Signal von dem durch die Transportlochung fallenden Licht ausgelöst wird. Das Zeichen im Puffer steht der Zentraleinheit während des Zyklus (ca. 2 msec.) und 3 msec. nach dem Lesen zur Verfügung.

Der Inhalt des Puffers wird vom nächsten Zeichen gelöscht. Ist keine Transportlochung vorhanden, so wird kein Zeichen gelesen.

6.2. Befehle

6.2.1. Lesen (*)
(Read)

Der Lochstreifenleser liest soviele Zeichen, wie der Lesebefehl angibt. Ist das Lesen beendet, so steht der Leser im Modus "Lesen vorwärts". Das Lesen kann durch das Signal "Ende des Lochstreifens" unterbrochen werden. Am Ende des Lesens enthalten die Kernspeicherstellen 0254 und 0255 die Adresse +1 des letzten in den Kernspeicher eingelesenen Bits.

6.2.2. Lesen rückwärts (*)
(Reverse read)

Die Bewegungsrichtung des Lochstreifens wird für die Anzahl der nach dem Befehl zu lesenden Zeichen umgekehrt. Dann wird der Leser wieder auf "Lesen vorwärts" eingestellt. Das Lesen kann vom Signal "Ende des Lochstreifens" unterbrochen werden. Am Ende des Lesens enthalten die Kernspeicherstellen 0254 und 0255 die Adresse -1 des letzten in den Kernspeicher eingelesenen Bits.

6.2.3. Einstellen des Modus "Lesen rückwärts"
(Set reverse read mode)

Dieser Befehl kehrt den Lesemodus um, d.h. die Randeinheit interpretiert den nächsten Lesebefehl als "Lesen rückwärts".

6.2.4. Rückspulen
(Rewinding)

Der Befehl spult den Lochstreifen zurück, bis das Signal "Ende des Lochstreifens" den Bewegungsvorgang unterbricht.

6.2.5. Manueller Eingriff
(Request for manual action)

Dieser Befehl schaltet den Leser in den Zustand Manuell. Der manuelle Status wird durch Drücken der Taste OPERATE gelöscht, sofern der Status ALERT (Außer Betrieb) nicht vorliegt.

(*) Bei Feststellung von "Ende des Lochstreifens" wird das sich unter dem Lesekopf befindende Zeichen in den Kernspeicher eingelesen. Dieses Zeichen ist 00 für Lochstreifen-Zufuhr. Der Inhalt der Kernspeicherstellen wird um +1 oder -1 verändert, je nach der Bewegungsrichtung des Lochstreifens.

6.3. Kontrolle auf Lesefehler

Während des Lesens findet keine Kontrolle statt. Lesefehler werden beim Übertrag von der Randeinheit in den Kernspeicher festgestellt und erscheinen als Übertragungsfehler (ERR1). Ein Lesefehler kann nur am Ende des Lesens bearbeitet werden.

6.4. Auswahl der Lochstreifenart

Der Operator stellt mit Hilfe der entsprechenden Schalter am Operator-Pult die Art des zu lesenden Lochstreifens ein, und zwar über drei Stellungen:

- A: Lochstreifen mit 8 Kanälen und Paarigkeitskontrolle, z.B. ISO 7 + 1

- B: Lochstreifen mit 8 Kanälen und Unpaarigkeitskontrolle, z.B. IBM und Friden

- C: Lochstreifen mit 7 Kanälen und Unpaarigkeitskontrolle, z.B. ISO 6 + 1.

Die Schalterposition C gilt auch für den Fernschreibcode, sofern der Leser hierfür eingerichtet ist.

6.5. Statusmeldungen

Die Randeinheit gibt an die Zentraleinheit verschiedene Zustandsmeldungen ab, die im folgenden erklärt werden.

6.5.1. Statusmeldung "Manuell"

Diese Statusmeldung tritt auf, wenn eine der folgenden Bedingungen vorliegt:

- Beim Einschalten der Spannung
- Bei einer Zustandsmeldung "Außer Betrieb" solange die Ursache hierfür bestehenbleibt
- Nach dem Befehl "Manueller Eingriff"
- Nach dem Drücken der Taste ON STOP, nachdem der noch vorliegende Befehl ausgeführt wurde.

Der manuelle Status wird durch Drücken der Taste OPERATE gelöscht, sofern die Bedingung "Außer Betrieb" nicht vorliegt.

6.5.2. Statusmeldung "Leser verfügbar"

Dieser Status tritt bei allen Signalen ein, die das Ende von Befehlen anzeigen:

- Lesen
- Lesen rückwärts
- Rückspulen
- Manueller Eingriff

Der Leser ist für die Zentraleinheit nicht verfügbar,

- nachdem die Randeinheit einen der vorstehend aufgeführten Befehle angenommen hat
- oder wenn die Randeinheit sich im Zustand "Manuell" befindet.

6.5.3. Statusmeldung "Außer Betrieb"

Die Randeinheit befindet sich im Status "Außer Betrieb", wenn eine der folgenden Bedingungen vorliegt:

- Keine elektrische Spannung im mechanischen Teil
- Keine Spannung in der elektronischen Überwachung
- Spulendeckel nicht richtig geschlossen

- Geschwindigkeitsschalter falsch eingestellt
- Lochstreifen fehlt
- Lochstreifen gerissen.

Im Zustand "Außer Betrieb" nimmt der Leser keine Befehle an.

Der Operator muß die Ursachen für den Zustand "Außer Betrieb" beseitigen und die Taste OPERATE drücken.

7. Tabelle der Befehle und Statusmeldungen

		Z		X	
		dezimal	hexadezimal	dezimal	hexadezimal
7.1.	Leserbefehle				
	Modus "Lesen rückwärts" einstellen	128	80	160	A0
	Rückspulen	128	80	68	44
	Manueller Eingriff	132	84	172	AC
7.2.	Übertragungsbefehle				
	Lesen vorwärts				
	- Adressen in aufsteigender Folge	16	10	64	40
	- Adressen in absteigender Folge	48	30	64	40
	Lesen rückwärts				
	- Adressen in aufsteigender Folge	16	10	65	41
	- Adressen in absteigender Folge	48	30	65	41
7.3.	Statusmeldungen				
	Leser mit Verzögerung verfügbar	192	C0	01	01
	Leser ohne Verzögerung verfügbar	196	C4	01	01
	Leser außer Betrieb (MARE)	196	C4	20	14
	Spannung am Leser eingeschaltet	196	C4	26	1A

	Z		X	
	dezimal	hexadezimal	dezimal	hexadezimal
Leser in "Manuell" (SECO).	196	C4	46	2E
Ende des Lochstreifens (TESE)	196	C4	18	12
Übertragungsfehler (ERCA)	196	C4	46	2E
Bedingtes ODER (TESE, MARE, ERCA, CAPE)	196	C4	68	44
Nicht angenommener Befehl (CAPE)	196	C4	30	1E

8. Bedienung des Lochstreifenlesers

8.1. Einschalten

Die ON-STOP Taste wird gedrückt. Ist die Spannung an der GE-115 eingeschaltet, leuchtet die ON-STOP-Lampe auf.

8.2. Ausschalten

a) Wenn der Leser in "ON-LINE" ist (OPERATE-Lampe brennt)

- ON STOP Taste drücken, Leser auf "Manuell" schalten
- Lochstreifen zurückspulen und entfernen
- OFF-Taste drücken.

b) Wenn ein Leser auf "Manuell ' steht:

- OFF-Taste drücken.

8.3. Einlegen des Lochstreifens

- Deckel öffnen
- Lochstreifenspule mit runden Lochungen auf die rechte Seite legen, Lochstreifen durch den Lesekopf führen und links um die Plastikspule legen. Ein festes Umwickeln ist nicht erforderlich, der Lochstreifen wird durch Reibung mitgenommen.
- Prüfen Sie die korrekte Stellung der Ausgleichsarme.
- Vor dem Lesekopf darf nur ein Streifen mit Transportlochungen, nicht mit Daten liegen.
- Deckel schließen. Dabei Stellung der Ausgleichsarme und der Testarme für Streifenende prüfen.
- Geschwindigkeitsschalter in die mittlere Stellung bringen. (500 Zeichen/sec.)
- Taste OPERATE drücken.

8.4. Abnehmen des Lochstreifens

- Leser auf "Manuell" schalten
- Lochstreifen zurückspulen.
- Deckel öffnen und Spule abnehmen.

8.5. Riß des Lochstreifens

Sollte der Lochstreifen abreißen, kann er notfalls mit einem farblosen klaren Klebstreifen zusammengeklebt werden. Dabei muß darauf geachtet werden, daß die Synchronlochungen genau übereinstimmen.

9. Wartung durch den Operator

Für eine einwandfreie Funktion der Maschine sind Wartungsarbeiten erforderlich, die der Operator durchführen muß.

Ferner sind einige spezielle Eingriffe erforderlich um Fehler zu beseitigen.

Alle Arbeiten müssen bei ausgeschalteter Maschine durchgeführt werden.

9.1. Material, Werkzeug

- Ein Staubsauger mit kleiner Plastik- oder Gummidüse
- ein kleiner Staubpinsel
- Baumwollgaze
- ein saugfähiger sauberer Lappen
- Methylalkohol.

9.2. Normale Wartungsarbeiten

Die einwandfreie Funktion des Lesers hängt hauptsächlich von der Sauberkeit der verschiedenen Teile ab, vor allem der Antriebsscheiben, des Lesekopfes und der verschiedenen Rollen.

Beim Reinigen dürfen keine Teile oder Lochstreifenreste in die Maschine fallen.

Treten während des Lesens periodisch Fehler auf, muß der Leser vor dem Einsatz eines Technikers vom Operator geprüft werden:

- Deckel öffnen
- Abdeckung vom Lesekopf entfernen.
- Prüfen Sie, ob die Lampe oder die Linse nicht staubig sind, gegebenenfalls müssen der Lesekopf, Linse und Lampe mit einem in Methylalkohol getauchten Tuch gereinigt werden.

Die Lampe darf nie mit bloßen Fingern angefaßt werden.

Zur Reinigung dürfen keine metallischen Gegenstände verwendet werden, da sonst die Oberflächen beschädigt werden.

Der Lesekopf muß jeden Tag vor dem Arbeitsbeginn mit einem weichen Pinsel gereinigt werden. Dazu muß der Deckel vollständig geöffnet werden, um einen guten Zugang zum Lesekopf zu bekommen.

Kapitel B

Lochstreifenleser PRT 101 für Lochstreifen mit rechteckigen Lochungen

1. Allgemeine Beschreibung

1.1. Aufgabe und Aufbau des Lochstreifenlesers

Der Lochstreifenleser PTR 101 liest Lochstreifen mit rechteckigen Lochungen und hat eine Lesegeschwindigkeit von 423 Zeichen in der Sekunde. Der PTR 101 besteht aus folgenden Hauptteilen:

- Transportvorrichtung für den Lochstreifen
- Bedienungspult
- Elektronische Einheit bestehend aus: fotoelektrischen Zellen, Verstärker für Leseimpulse, Ein-/Ausschalter (ON/OFF)
- Verbindungseinheit, um die Randeinheit an den Rechner anzuschließen.

1.2. Interface

Die Randeinheit wird über ein Standard-Interface an den Rechner GE - 115 angeschlossen.

2. Datenträger

2.1. Eigenschaften des Lochstreifens

Als Datenträger dient ein Lochstreifen mit einer Breite von 20,5 mm. Der Lochstreifen hat 6 Kanäle und entspricht den Normen für Olivetti-Lochstreifen.

2.2. Datenübertrag

Eine Lochung in einem Kanal des Lochstreifens setzt das entsprechende Bit im Kernspeicher auf 1. Fehlt die Lochung im Kanal, so wird das entsprechende Bit im Kernspeicher auf 0 (Null) gesetzt. Der Datenübertrag vom Lochstreifen (Lochcode) in den Kernspeicher (interner Maschinencode) geht nach folgendem Schema vor sich:

Lochcode gelesene Bits			6	5	4	3	2	1
Zeichen im Kernspeicher (interner Maschinencode)	6	$\bar{6}$	6	5	4	3	2	1

Lochungen in den Kanälen 1 bis 6 belegen die Bits a bis f im internen Maschinencode (8-Bit-Zeichen). Bit g des internen Codes enthält den Komplementärwert von Bit f, während Bit h den Wert des Kanals 6 (= Bit f) enthält.

3. Beschreibung des Lochstreifenlesers

3.1. Zufuhr des Lochstreifens

Die mechanische Vorrichtung zur Aufnahme und zum Transport des Lochstreifens besteht aus:

- 2 Spulen
- 2 Spannarmen
- 2 Andruckrollen .

Jede Spule hat einen Kontakt, der das Ende des Lochstreifens anzeigt. Bei Abgabe dieser Signale muß die Bewegung des Lochstreifens sofort unterbrochen werden, da der Lochstreifen durch einen Reibungseffekt in der Mitte der Spule gehalten wird. Der Reibungseffekt wird durch den Kontakt "Ende des Lochstreifens" erzeugt.

3.2. Lesekopf

Der Lesekopf befindet sich zwischen den beiden Andruckrollen und besteht aus:

- Zwei Reihen mit je 6 Fotozellen
- Einer Lichtquelle
- Einer Linse, um die Lichtstrahlen zu bündeln
- Einer mechanischen Vorrichtung zum Ausrichten der Lichtquelle, der Linse und der Fotozellen. Mit dieser Vorrichtung wird der Abstand zwischen dem Lochstreifen und dem Führungsblech auf ein Minimum eingestellt.

3.3. Geschwindigkeiten

Über eine mechanische Vorrichtung läßt sich durch einen Schalter die Transportgeschwindigkeit des Lochstreifens auf 3 Stufen einstellen:

- Langsam
  = 211 Zeichen pro Sekunde
  (nicht benutzt)

- Normal

  = 423 Zeichen pro Sekunde
  (zum Lesen)

- Schnell

  = 656 Zeichen pro Sekunde
  (zum manuellen Rückspulen)

3.4. Mikroschalter zum Testen der Fehler

Zwei Mikroschalter kontrollieren:

- ob der Spulendeckel geschlossen ist;
- die Einstellung des Geschwindigkeitsschalters auf 423 Zeichen pro Sekunde.

3.5. Datenformat

Der Leser liest Datenblöcke, die durch eins der Halt-Zeichen begrenzt werden. Auf jedes Halt-Zeichen folgen drei Leerzeichen (000000), sodaß der Lochstreifen ohne Verlust eines Datenzeichens angehalten werden kann.

4. Operator-Pult

4.1. Leuchtanzeigen

OFF	- Die Einheit ist außer Betrieb. - Die Anzeige leuchtet nach Drücken der Taste OFF auf.
ON-STOP	- Die Netzspannung ist eingeschaltet. - Die Anzeige leuchtet auf, wenn der Lochstreifenleser eingeschaltet wird.
OPERATE	- Die Anzeige leuchtet auf, wenn der Leser im Modus on-line arbeitet. Der Leser kann nicht vom Pult aus gesteuert werden.
ALERT	- Die Anzeige leuchtet auf, wenn eine der Bedingungen "Außer Betrieb" vorliegt. Die Anzeige erlischt, wenn die Bedingungen beseitigt worden sind.
TAPE END START →	- Die linke Seite der Anzeige bedeutet "Ende des Lochstreifens" bei "Lesen vorwärts". - Die rechte Seite der Anzeige ist bei Vorwärtsbewegung des Lochstreifens erleuchtet.
TAPE END START ←	- Die Anzeige entspricht der Bewegungsrichtung des Lochstreifens (siehe →).

4.2. Drucktasten

OFF	- Durch Drücken dieser Taste wird der Leser abgeschaltet. - Die Anzeige OFF bleibt erleuchtet.
ON STOP	- Die Taste dient zum Einschalten der Spannung am Leser - Durch Drücken der Taste wird der Leser auf Manuell geschaltet. - Durch Drücken der Taste wird die Zufuhr des Lochstreifens im Zustand Manuell unterbrochen.
OPERATE	- Durch Drücken der Taste wird der Leser auf OPERATE geschaltet, die entsprechende Anzeige leuchtet auf. - Die Taste hebt die Bedingungen auf, die den Leser auf Manuell geschaltet haben und löscht das Signal "Leser belegt".
TAPE END START →	- Befindet sich der Leser im Modus off-line, so bewirkt diese Taste den Weiterlauf des Lochstreifens, bis die Taste ON STOP gedrückt oder "Ende des Lochstreifens" festgestellt wird.
TAPE END START ←	- Die Anzeige entspricht der Bewegungsrichtung des Lochstreifens (siehe →).

SWITCH

Schalter mit 3 Stellungen folgender Bedeutung :

- Stellung A:

  Der Leser hält an, sobald er eines der folgenden Halt-Zeichen vorfindet:

Kanal	Zeichen
6 5 4 3 2 1	
0 0 0 1 1 1	CL 3A
0 0 1 1 1 1	CL 1A
0 1 0 1 1 1	CL 4A
0 1 1 1 1 1	CL 2A
1 0 0 1 1 1	CL 3R
1 0 1 1 1 1	CL 1R
1 1 0 1 1 1	CL 4R
1 1 1 1 1 1	CL 2R

- Stellung B: ALERT

  (Außer Betrieb)

- Stellung C:

  Der Leser hält an, wenn er das Halt-Zeichen CL 2R (111111) vorfindet.

5. Prüfen der logischen Funktionen

5.1. Zustand des Lesers

Der Befehl auf Vorschub des Lochstreifens wird nicht angenommen, wenn kein Lochstreifen vorhanden oder der Spulendeckel nicht geschlossen ist.

5.2. Vorschub des Lochstreifens

Das Signal "Ende des Lochstreifens" macht die Befehle für den Lochstreifen, bis auf die Befehle zur Umkehrung der Bewegungsrichtung, unwirksam.

6. Lochstreifenleser

6.1. Einlesen eines Zeichens in den Kernspeicher

Der Leser ist mit einem Puffer für 6 Bits ausgestattet. Vor dem Übertrag der Daten in den Kernspeicher werden die Zeichen durch zweimaliges Lesen miteinander verglichen. Bei Ungleichheit der gelesenen Zeichen sendet die Randeinheit das Signal "Lesefehler" an die Zentraleinheit. Erst nach Beendigung des Lesevorganges läßt sich der Fehler bearbeiten. Das Zeichen im Puffer wird von 6 auf 8 Bits umgeschlüsselt und ein Unpaarigkeitsbit wird generiert. Das neue Zeichen wird dann in den Rechner übertragen.

6.2. Befehle

6.2.1. Lesen vorwärts (Read forward)

Dieser Befehl löst das Lesen des Lochstreifens aus. Das Lesen wird erst unterbrochen, wenn der Leser ein Halt-Zeichen vorfindet (siehe 4.2.7.) oder bei dem Signal "Ende des Lochstreifens". Wenn der Befehl "continua" (Fortsetzung) später als 2,4 msec nach dem Ende der Leseoperation eintrifft, so wird der Transport des Lochstreifens unterbrochen, sobald das Halt-Zeichen den Lesekopf erreicht. Der Befehl "continua" kann zur Rückstellung des Lochstreifens um n-Blöcke benutzt werden, vorausgesetzt die Zeitintervalle (2,4 msec) werden berücksichtigt.

6.2.2. Fortsetzung ("continua")

Zur Anwendung dieses Befehles siehe 6.2.1.

Trifft dieser Befehl später als 2,4 msec nach dem Ende des letzten Lesebefehles ein, so wird er vom Leser ignoriert.

6.2.3. Lesen rückwärts
(Read reverse)

Dieser Befehl veranlaßt, daß der Lochstreifen rückwärts transportiert wird. Die Operation wird beendet

- durch das Erkennen eines Halt-Zeichens oder
- durch das Signal "Ende Lochstreifen".

Der Befehl "continua" kann zur Rückstellung des Lochstreifens um n-Blöcke benutzt werden, wenn die Zeitintervalle (2,4 msec) berücksichtigt werden.

6.2.4. Rückspulen (Rewind)

Dieser Befehl spult den Lochstreifen so weit zurück, bis das Signal "Ende des Lochstreifens" den Bewegungsvorgang unterbricht.

6.2.5. Löschen des Fehlers

Der Befehl stellt das Flip-flop in die normale Lage zurück.

6.2.6. Manueller Eingriff

Dieser Befehl versetzt den Leser in den Zustand "Manuell" (off-line). Nach dem manuellen Eingriff wird durch Drücken der Taste der Status Manuell gelöscht, wenn der Status "Außer Betrieb" nicht vorliegt.

6.3. Statusmeldungen

6.3.1. Leser im Status "Manuell"

Dieser Status tritt unter den folgenden Bedingungen auf:

- Beim Einschalter der Spannung.
- Bei einer Zustandsmeldung "Außer Betrieb", solange die Ursache hierfür nicht beseitigt worden ist.
- Nach einem Befehl "Manueller Eingriff".
- Nach dem Drücken der Taste OPERATE, nachdem der vorliegende Befehl ausgeführt worden ist.

Der Status "Manuell" wird durch Drücken der Taste OPERATE gelöscht, sofern die Bedingung "Außer Betrieb" nicht vorliegt.

6.3.2. Leser verfügbar

Dieser Status tritt bei allen Signalen ein, die das Ende von folgenden Befehlen anzeigen:

- Lesen
- Lesen rückwärts
- Rückspulen
- Manueller Eingriff.

Befindet sich der Leser im Status "Manuell", so ist er nach Annahme der obengenannten Befehle nicht verfügbar.

6.3.3. Statusmeldung "Außer Betrieb"

Die Randeinheit befindet sich im Status "Außer Betrieb", wenn eine der folgenden Bedingungen vorliegt:

- Keine Spannung im mechanischen Teil
- Keine Spannung in der elektronischen Überwachung
- Spulendeckel nicht richtig geschlossen
- Geschwindigkeitsschalter falsch eingestellt
- Schalter zur Auswahl des Halt-Zeichens steht auf der Position "Außer Betrieb"
- Lochstreifen fehlt
- Lochstreifen gerissen.

Im Status "Außer Betrieb" nimmt der Leser keine Befehle zum Transport des Lochstreifens an. Der Operator muß die Ursachen für "Außer Betrieb" beseitigen und die Taste OPERATE drücken.

7. Tabelle der Befehle und Statusmeldungen

7.1. Leserbefehle

	Z		X	
	dezimal	hexa-dezimal	dezimal	hexa-dezimal
Rückspulen	128	80	68	44
Löschen des Fehlers	132	84	71	47
Manueller Eingriff	132	84	172	AC
Fortsetzung des Lesens	132	84	171	AB
7.2. Übertragungsbefehle				
Lesen vorwärts:				
- Adressen in aufsteigender Folge	16	10	64	40
- Adressen in absteigender Folge	48	30	64	40
Lesen rückwärts:				
- Adressen in aufsteigender Folge	16	10	65	41
- Adressen in absteigender Folge	48	30	65	41
7.3. Statusmeldungen				
a) Leser mit Verzögerung verfügbar	192	C0	01	01
b) Leser ohne Verzögerung verfügbar	196	C4	01	01
c) Lesefehler	196	C4	03	03
d) Ende des Lochstreifens	196	C4	18	12
e) Außer Betrieb	196	C4	20	14
f) Leser in Manuell	196	C4	46	2E
g) Übertragungsfehler	196	C4	66	42
h) Befehl abgewiesen	196	C4	30	1E
i) Bedingtes ODER (c,d,e,f,h)	196	C4	68	44
j) ODER-Befehl (c,g)	196	C4	74	4A
k) Spannung am Leser eingeschaltet	196	C4	26	1A

8. Bedienung des Lochstreifenlesers

8.1. Einschalten

Die ON-STOP-Taste wird gedrückt. Ist die Spannung an der GE-115 eingeschaltet, leuchtet die ON-STOP-Lampe auf.

8.2. Ausschalten

a) Wenn der Leser in "ON-LINE" ist (OPERATE-Lampe brennt)

- ON STOP-Taste drücken, Leser auf "Manuell" schalten
- Lochstreifen zurückspulen und entfernen
- OFF-Taste drücken.

b) Wenn ein Leser auf "Manuell" steht:

- OFF-Taste drücken.

8.3. Einlegen des Lochstreifens

- Deckel öffnen
- Lochstreifenspule mit rechteckigen Lochungen auf die linke Seite legen, Lochstreifen durch den Lesekopf führen und rechts um die Plastikspule legen. Ein festes Umwickeln ist nicht erforderlich, der Lochstreifen wird durch Reibung mitgenommen.
- Prüfen Sie die korrekte Stellung der Ausgleichsarme.
- Vor dem Lesekopf darf nur ein Streifen mit Transportlochungen, nicht mit Daten liegen.
- Deckel schließen. Dabei Stellung der Ausgleichsarme und der Testarme für Streifenende prüfen.
- Geschwindigkeitsschalter in die mittlere Stellung bringen. (500 Zeichen/sec.)
- Taste OPERATE drücken.

8.4. Abnehmen des Lochstreifens

- Leser auf "Manuell" schalten
- Lochstreifen zurückspulen
- Deckel öffnen und Spule abnehmen.

8.5. Riß des Lochstreifens

Sollte der Lochstreifen abreißen, kann er notfalls mir einem farblosen klaren Klebstreifen zusammengeklebt werden. Dabei muß darauf geachtet werden, daß die Synchronlochungen genau übereinstimmen.

9. Wartung durch den Operator

Für eine einwandfreie Funktion der Maschine sind Wartungsarbeiten erforderlich, die der Operator durchführen muß.

Ferner sind einige spezielle Eingriffe erforderlich um Fehler zu beseitigen.

Alle Arbeiten müssen bei ausgeschalteter Maschine durchgeführt werden.

9.1. Material, Werkzeug

- Ein Staubsauger mit kleiner Plastik- oder Gummidüse
- ein kleiner Staubpinsel
- Baumwollgaze
- ein saugfähiger sauberer Lappen
- Methylalkohol.

9.2. Normale Wartungsarbeiten

Die einwandfreie Funktion des Lesers hängt hauptsächlich von der Sauberkeit der verschiedenen Teile ab, vor allem der Antriebsscheiben, des Lesekopfes und der verschiedenen Rollen.

Beim Reinigen dürfen keine Teile oder Lochstreifenreste in die Maschine fallen.

Treten während des Lesens periodisch Fehler auf, muß der Leser vor dem Einsatz eines Technikers vom Operator geprüft werden:

- Deckel öffnen
- Abdeckung vom Lesekopf entfernen.
- Prüfen Sie,ob die Lampe oder die Linse nicht staubig sind. Gegebenenfalls müssen der Lesekopf, Linse und Lampe mit einem in Methylalkohol getauchten Tuch gereinigt werden.

Die Lampe darf nie mit bloßen Fingern angefaßt werden.

Zur Reinigung dürfen keine metallischen Gegenstände verwendet werden, da sonst die Oberflächen beschädigt werden.

Der Lesekopf muß jeden Tag vor dem Arbeitsbeginn mit einem weichen Pinsel gereinigt werden. Dazu muß der Deckel vollständig geöffnet werden, um einen guten Zugang zum Lesekopf zu bekommen.

Kapitel C

Lochstreifenstanzer PTP 100

1. Allgemeine Beschreibung

1.1. Aufbau des Lochstreifenstanzers

Der Lochstreifenstanzer PTP 100 besteht aus folgenden Teilen:

- Spule für den Leerstreifen
- Mechanismus zum Stanzen und zum Transport des Lochstreifens
- Spule für den gestanzten Streifen

Der Durchmesser der Spulen beträgt:

- Außen 8 Zoll
- Innen 2 Zoll.

Der Stanzmechanismus besteht aus einer Stanzeinheit und einer Reihe von Zwischenhebeln, die durch Elektromagnete betätigt werden. Wird ein Elektromagnet unter Spannung gesetzt, so erfolgt eine Lochung, wenn sich der Stanzstempel nach unten bewegt. Zu einem Stanzzyklus gehört der Transport des Lochstreifens nach dem Stanzen. Nach Ablauf eines Zyklus kann wieder gestanzt werden. Im Falle eines Fehlers kann kein Löschzeichen gestanzt werden, da eine Rückwärtsbewegung des Lochstreifens nicht möglich ist.

Der Stanzkopf und die Transportvorrichtung sind in folgenden Ausführungen lieferbar:

- Für Lochstreifen von 1 Zoll Breite mit 8 Kanälen und runden Löchern.
- Für Lochstreifen von 7/8 Zoll Breite mit 7 Kanälen und runden Löchern.
- Für Lochstreifen von 11/16 Zoll Breite mit 5 Kanälen und runden Löchern.
- Für Olivetti-Lochstreifen mit 6 Kanälen und rechteckigen Löchern.

Der Stanzer kann maximal 60 Zeichen pro Sekunde stanzen.

Die Aufnahmespule wickelt den Lochstreifen automatisch, d.h. ohne manuelles Eingreifen, von Anfang an auf.

1.2. Datenträger

Der zu verwendende Papierstreifen soll geölt sein (max. 12%) und wenig mineralische Bestandteile enthalten (max. 0,4%). Diese beiden Eigenschaften tragen wesentlich zur Lebensdauer der Randeinheit bei. (Siehe ECMA-Normen für Bandeigenschaften).

1.3. Interface

Die Randeinheit wird über das Standard-Interface 100 an den GE - 115 angeschlossen.

2. Befehle und Signale

2.1. Stanzen
(Punch)

Die Randeinheit nimmt den Befehl nur im Status OPERATE an und führt folgende Funktionen aus:

- Einschalten der Spannung
- Löschen aller Stanzfehler-Bedingungen
- Stanzen der Daten, die von dem Befehl übertragen und gesteuert werden.

2.2. Manueller Eingriff

Die Randeinheit nimmt den Befehl sowohl im Status OPERATE als auch im Status "Manuell" an.

Der Stanzer wird auf "Manuell" (off-line) geschaltet und ist nicht verfügbar.

2.3. Einheit verfügbar

Die Randeinheit ist während des Datenübertrages aus dem Kernspeicher bis zur Beendigung des Stanzens nicht verfügbar.

Tritt eine Bedingung für "Außer Betrieb" ein, so ist die Randeinheit auch während eines Datenübertrages sofort verfügbar.

2.4. Außer Betrieb

Die Randeinheit geht beim Auffinden einer der folgenden Bedingungen in den Status "Außer Betrieb" über:

a) Einheit nicht verfügbar

b) mechanische Störung

c) Leerstreifen nicht vorhanden

d) Streifen ist nicht richtig eingelegt.

Die Signale b), c), d) schalten den Stanzer auf MANUAL (off-line).
Bei der Anzeige a) sind die Tasten MANUAL und OPERATE zu drücken, bei b) die Taste OPERATE.

2.5. Hinweis auf Streifenende

Diese Anzeige weist darauf hin, daß sich nur noch 3 bis 4 m Leerstreifen auf der Zufuhrspule befinden. Dieses Signal unterbricht den eintreffenden Stanzbefehl nicht.

2.6. Stanzer in "MANUAL"

Wird eine Bedingung für "Außer Betrieb" festgestellt oder die Taste MANUAL gedrückt so wird der Stanzer in den Status MANUAL geschaltet. Der Status MANUAL wird durch Drücken der Taste OPERATE gelöscht.

2.7. Stanzfehler

Diese Anzeige tritt auf, wenn der Stanzer eine falsche Stellung der Zwischenhebel feststellt. Die Anzeige wird durch den Befehl "Stanzen" gelöscht.

2.8. Kanalfehler

Diese Anzeige weist auf einen Übertragungsfehler in der Information (Befehl oder Daten) aus dem Rechner hin.

2.9. Wahrscheinlichkeitsfehler
(Plausibility error)

Diese Anzeige tritt in den folgenden Fällen auf:

- Unbekannter Befehl
- Der Befehl wurde gegeben, während der Streifenstanzer nicht verfügbar war.
- Der Befehl wurde gegeben, während der Streifenstanzer im Status MANUAL (off-line) war.
- Befehl mit Übertragungsfehler
- Bit 6 $\neq$ Bit 8 in einem Datenzeichen.

3. Kontrollen

3.1. Kontrolle der Eingabeinformationen

Der Streifenstanzer kontrolliert bei den zu stanzenden Daten sowohl die Paarigkeitsbits (vgl. Abschnitt 2.8.) als auch ihre Wahrscheinlichkeit. (vgl. Abschnitt 2.9. Plausibilitätskontrollen).

3.2. Kontrolle der Ausgabedaten (Stanzen)

Der Streifenstanzer prüft, ob ein Unterschied zwischen dem zu stanzenden Zeichen (Puffer) und dem durch die Zwischenhebel dargestellten Zeichen vorliegt. Ist ein Unterschied vorhanden, so wird das fehlerhafte Zeichen gestanzt und das Signal "Stanzfehler" gegeben.

4. Operator-Pult

4.1. Drucktasten

4.1.1.	OFF	Durch Drücken dieser Taste wird die Spannung abgeschaltet und die Leuchtanzeige eingeschaltet.
4.1.2.	ON-STOP	Durch Drücken dieser Taste wird die Spannung am Stanzer eingeschaltet. Bei eingeschalteter Spannung wird durch Drücken dieser Taste der Stanzer in den Modus off-line (MANUAL) geschaltet.
4.1.3.	OPERATE	Durch Drücken dieser Taste wird die Bedingung für den Status MANUAL gelöscht und der Stanzer auf on-line geschaltet. Die zugehörige Leuchtanzeige wird eingeschaltet.
4.1.4.	MANUAL	Solange diese Taste gedrückt wird, erfolgt Streifenvorschub ohne Stanzen. Diese Taste wird nur dann wirksam, wenn sich der Stanzer im Status MANUAL befindet.
4.1.5.	MANUAL PUNCH	Solange diese Taste gedrückt wird, erfolgt Streifenvorschub, wobei das Zeichen, das alle Stanzstempel benötigt, gestanzt wird (DELETE-Zeichen). Diese Taste wird nur dann wirksam, wenn sich der Stanzer im Status MANUAL befindet.
4.1.6.	SWITCH	Dieser Schalter dient zur Auswahl des zu stanzenden Code: - ISO 7 + 1 - IBM / FRIDEN - ISO 6 + 1 - TELEX - AUDIT

4.2. Leuchtanzeigen

4.2.1.	OFF	Siehe 4.1.1.
4.2.2.	MANUAL	Siehe 4.1.2.
4.2.3.	OPERATE	Siehe 4.1.3.
4.2.4.	ALERT	Siehe 2.4.
4.2.5.	NEAR END OF TAPE	Siehe 2.5.

5. Tabelle der Befehle und Statusmeldungen

(Kanal 1)

		Befehle	
5.1.	Befehle für den Rechner	Z	X
	Manueller Eingriff	84	0C
5.2.	Übertragungsbefehle		
	– Adressen in aufsteigender Folge	50	42
	– Adressen in absteigender Folge	70	42
5.3.	Statusmeldungen		
	a) Einheit verfügbar (ohne Verzögerung)	C4	01
	b) Einheit "Außer Betrieb" (ohne Verzögerung)	C4	14
	c) Einheit in MANUAL	C4	2E
	d) Kanalfehler	C4	42
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GE 100 Line
CTW101

Honeywell Bull

Code 3911115 N

Réf. 32.22.501 A

GE 100 Line
CTW101

DECEMBER 1970

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Code 3911115 N

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PREFACE

This manual has been produced by Honeywell Information Systems Italia. The terminology used in this manual is according to the International Federation for Information Processing and the International Computation Centre (IFIP/ICC) Vocabulary of Information Processing.

Suggestions and comments pertaining to form, content, purpose, or use of this manual are invited. Comments may be sent on the Document Review Sheet which appears at the rear of this manual.

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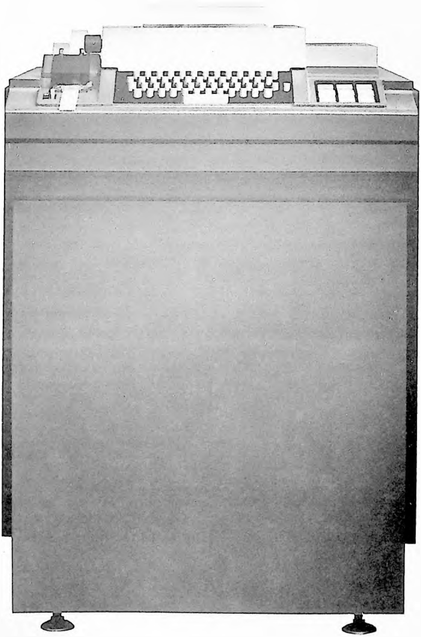
INTRODUCTION

This manual describes the "CTW101 Console Typewriter" Subsystem for use with systems in the GE-100 Line. It is intended primarily as a reference manual for analysts/programmers and operators.

Major divisions of information in this manual are as follows:

Part I :	A brief general description of the capabilities of the subsystem; here its components are listed, and it is described how the subsystem is connected to CPU in the GE-100 Line.
Part II :	A description of I/O media including code expansion and compression conventions, and considerations for the use of paper tape with this subsystem.
Part III:	Description of the component parts of the subsystem including the cabinet, typewriter, paper tape reader/punch, controller, and the operator's control panel.
Part IV:	Description of on-line and off-line operation, the manner in wich input and output is processed, how operator intervention may be accomplished, echoplex capability, and interrupts.
Part V:	The programming part of this manual contains a brief mention of the format of PER and PERI I/O instructions used for this subsystem, their functions, the manner in which they are coded, and some considerations regarding timing.
Part VI:	Operating Procedures.
Appendices:	The appendices contain a list of related manuals, status signals, the character set used, and physical characteristics of the subsystem.



PART I. GENERAL DESCRIPTION

A. FUNCTIONAL CHARACTERISTICS

The CTW101 Console Typewriter is a peripheral input/output subsystem designed for use with systems in the GE-100 Line. As an input device, it permits information to be entered into core store by means of its keyboard; as an output device if can be used to type information at the rate of 10 characters per second.

In use, it may replace part of the functions of the card reader and line printer as a control device for EDOS. It can also be used for access to disc files and for the output of messages to the operator.

B. SYSTEM CONFIGURATION

The CTW101 subsystem can be connected to two systems in the GE-100 Line: the GE-120 and GE-130. These connections can be made directly to connector 3 or 4 or by means of an MPA (Multiple Peripheral Adapter).

It is especially useful in systems utilizing disc storage subsystems since it can be used to interrogate such store and receive a print-out of the contents. With all types of systems, the CTW101 can be used to communicate with the operating system regarding various facets of processing progress.

C. CTW101 CONFIGURATION

This section of the manual contains a list of the CTW101 components. A more detailed description of each appears in Part III; the physical characteristics such as size, weight, etc. are listed in Appendix D.

The components of the CTW101 are:

Controller
I/O Typewriter
Paper Tape Reader/Punch
Operator's Control Panel
Cabinet

PART II. INPUT/OUTPUT MEDIA AND FORMATS

A. INPUT/OUTPUT MEDIA

The Typewriter paper must be in 8 1/2 inch wide rolls and no more than 5 inches in diameter.

The paper tape used in the Paper Tape Reader/Punch is the standard eight level type, one inch in diameter,10 characters per inch.

B. DATA FORMATS

1. General

The format of messages transferred between the CPU and the subsystem buffer, and the manner in which this is accomplished, is described in Part IV of this manual.

2. Input/Output between CPU and Keyboard

Information exchanged between the CTW101 and the CPU is in ASCII 7+1 bit code. This code requires 7 bits to represent each character; the added bit position represents the parity bit. In store, the systems of the GE-100 Line use an 8 + 1 bit code configuration. Whenever a transfer of information to the subsystem buffer from the CPU occurs the code must undergo a translation which involves conversion from the 8 + 1 bit store configuration to an 8 + 1 bit expanded ASCII code.

This latter code is shown in Appendix B. This expanded ASCII code is then compressed to the standard 7 + 1 bit ASCII code for use in the subsystem.

In the opposite direction, the sequence of operations outlined above, is reversed.

3. Output of Printer

The character set which can be output at the printer is shown in Appendix B.

In printing, 74 print positions are available with a horizontal spacing of 10 character positions per inch. Vertical spacing is 6 lines per inch.

4. Input/Output Considerations on Paper Tape Reader/Punch

In using the paper tape reader/punch, a number of factors regarding input and output at this type device should be considered. They are discussed in following paragraphs.

The only bit configurations that may appear in a paper tape used for input are those of the 64 characters of the printing set and the configurations that indicate the CARRIAGE RETURN and LINE FEED functions.

Each information block may be a maximum of 255 characters and must include an "end" element (X-OFF) as its last character also in the case the ASO option is not used (see III A, 3c). At the beginning of each tape a number of CARRIAGE RETURN configurations must appear to permit the equipment to assume a proper reading orientation.

When a bit configuration other than that of a character in the printing set is read from a paper tape, the SEGE status signal, indicating an erroneous message, is issued. If an information block contains more than 255 characters, the SEGE status signal is issued and the overflow indicator is lit.

Paper tape may be manually prepared with the subsystem off-line (in Standby mode). During punching the printer portion of the subsystem is also functioning.

If the ASO101 option is not being used, only one information block may be on tape and it must be smaller than the capacity of the buffer.

Any attempt to use the X-OFF configuration in a normal string of characters will not result in a halt to reading when the X-OFF configuration is encountered. Reading in this case will only terminate at the end of the tape, but the buffer will only receive the characters preceding the first X-OFF.

PART III. CTW101 DESCRIPTION

A. MECHANICAL DESCRIPTION

The components of the CTW101 are: Controller; I/O Type-writer; Paper Tape Reader/Punch; Operator's Control Panel; and the Cabinet. All are described individually in following paragraphs. Physical characteristics such as the size, weight, etc. appear in Appendix C.

1. Cabinet

The cabinet has two principal functions: it serves as a container for the electromechanical assembly; and contains the controller and logical function circuitry.

Its configuration permits the operator to work at the controls, in either a standing or sitting position. It is also positioned such that the operator has access to its control panel and the operator's console of the computer systems without excessive movement. This permits a more direct and rapid control of the operating system during processing.

2. Typewriter

Basically, the function of the typewriter is to permit insertion of information into core store by means of the keyboard.

a. Keyboard

The typewriter keyboard is shown in the following illustration:

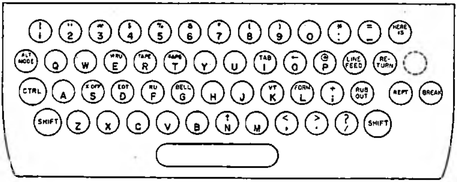


Figure 1. Keyboard

The functions WRU, TAPE, TAB, VT, FORM, RU, BELL, HEREIS, ALT MODE, RUBOUT, BREAK are not used in CTW101.

Three types of information may be sent to the CPU by means of the keyboard: characters; control functions; and special functions.

1) Transmission of characters

These are the 63 symbols defined in the graphic character set and are generated by pressing the corresponding keys with or without using the SHIFT Key.

a) SHIFT key "off"

If the SHIFT key is not pressed, 42 characters may be typed (by pressing a key with two characters, the lower character is printed).

The control functions are not active but some special functions are as shown on page 12, par. 3).

b) SHIFT key "on"

If the SHIFT key is pressed, 21 characters may be typed. Of these, 18 are on character shaving keys, and appear at the top of the keys, the three additional characters are as follows:

[, by pressing the VT key

\, by pressing the FORM key

], by pressing the M key.

The "special function" keys are blocked with the exception of REPT.

2) Transmission of control functions
The control functions that may be used are: X-OFF and EOT. These functions are accessed by use of the CTRL key and the specific key required.

When the CTRL key is pressed, all but the following character keys are blocked: W, Y, U, O, P, A, H, K, L, Z, X, C, V, B, N.

3) Transmission of special functions

The special functions which may be accessed directly include: LINE FEED, RETURN and REPT.

These hare the following functions:

LINE FEED	causes a single-line feed
RETURN	causes a carriage return
REPT	causes the subsequently struck symbol to be repeated.

When the CTRL key is pressed, the activation of J or M key generates the following functions: when J is pressed, it activates the LINE FEED function (the LINE FEED key is also operative);when M is pressed, it activates the RETURN function (the RETURN key is also operative).

4) Print mechanism

The print mechanism has several functions:

It performs the printing
It may suppress printing
It effects the CARRIAGE RETURN function
It effects the LINE FEED function

The characters are formed by raised portions of the surface of the printing head (see figure 2). Upon receipt of an appropriate pulse, the head is positioned so that the symbol required may be printed in the appropriate position. When the horizontal and vertical positioning of the cylinder is complete, the second phase of printing is performed by a hammer which strikes the cylinder leaving the impression of the character on the paper.

▼	&	%	$	#	▼▼	!	A^M SP	(	)	*	+	,	-	.	/
G	F	E	D	C	B	A	@	H	I	J	K	L	M	N	O
7	6	5	4	3	2	1	0	8	9	:	;	<	=	>	?
W	V	U	T	S	R	Q	P	X	Y	Z	[	\	]	↑	←
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

COLONNE VERTICALI COLONNE VERTICALI

Figure-2. Printing Head

Printing may be suppressed by the print suppression mechanism which prevents the printing hammer from being actuated.

Upon receipt of the Carriage Return code, the carriage return mechanism causes the printing assembly to more to the extreme left side of the page, without line spacing.

Upon receipt of the Line Feed code, the line feed mechanism causes the paper to more to the next, printing line position.

c. Paper movement

Paper movement in the subsystem is accomplished by a friction drive.

3. Paper Tape Reader/Punch

To simplify explanation of this mechanism, the description is divided into the component parts of its functions: reading paper tape and punching paper tape.

a. Reading paper tape

The reading mechanism is located at the left of the keyboard. The manual switch which controls its use has three positions which function in the following manner;

FREE	The tape feed wheel is free to move so that paper may be installed, removed, or its position may be changed.
STOP	The tape feed wheel cannot be moved and the reader does not function.
START	Activates the reader, permitting the reading of information.

Information is read at the rate of ten characters per second. The end-of-tape mechanism will halt reading when an end-of-tape or torn tape is sensed at the feed mechanism.

Feeding of tape and reading are some what independent in that the feed operates in a manner that always leaves a reserve of tape to be read, before the reading station. This is done to eliminate in the tape at this point.

b. Punching paper tape

This mechanism is located at the left of the keyboard. It has a console with four buttons whose function is as follows:

ON	actuates the punch
OFF	disables the punch
RELEASE	releases the tape to permit proper positioning of the tape at the punching station
BACK SPACE	permits moving the tape backwards, access one or more positions part the punching station.

Information is punched at the rate of ten characters per second. Feeding of tape is performed in a manner that leaves a reserve at the punching station. This is done to eliminate tension in the tape at this point.

c. ASO101 option

This option permits automatic termination of reading of the paper tape. When the special configuration of the X-OFF character is encountered. The character following X-OFF is also read and the reading stops at the second character following the X-OFF configuration.

If the character immediately following the X-OFF is a Carriage Return or Line Feed configuration, the operation will be executed. If it is a control character or a member of the graphic set, it will be ignored as access to the buffer is terminated when X-OFF is encountered.

Obviously, when more than one block are to be contained on a tape, the character following the X-OFF should be used for filling purposes or request a Line Feed or Carriage Return function.

To begin reading after a halt caused by reading an X-OFF, the manual switch should be positioned on START. In this case, the first character read will be the second following the X-OFF.

B. CONTROLLER DESCRIPTION

The controller provides the logical and electromechanical interface between the CPU of the system and the functions of the CTW101.

It contains a 256 character position buffer it decodes instructions from the CPU and executes the necessary command functions. The transfer of information is accomplished by program instructions which are described in greater detail in Part V of this manual.

The controller performs checks on information transferred between the CPU and the subsystem, as follows:

Even parity check on characters sent from the subsystem.

Even parity check on characters leaving the buffer Odd parity check on instructions and data arriving from the CPU.

Control of commands issued with the subsystem in Standby or not available.

Check on correct sequence of commands issued by the CPU during the input phase.

Check to ensure that all bit configurations sent from the subsystem to the CPU represent characters in the graphic set.

Check for erroneous messages, upon command from keyboard.

Check for nearly-full buffer.

Overflow check.

A clock in the subsystem provides the CPU with interrupt signals at 20 ms intervals. The type of signal and manner in which it is sent is described more completely in Appendix B of this manual, with the description of the status signals. The status signals can briefly be classified in the following manner:

> Those which affect status indicators at the CPU and therefore can be tested by the program in execution;
>
> Those that are displayed at the operator's control panel;
>
> All other signals.

C. OPERATOR'S CONTROL PANEL

The following illustration shows the arrangement of controls and indicator lights on the operator's control panel.

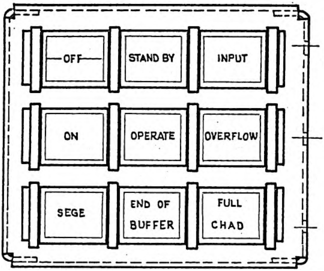


Figure 3. Control Panel

The controls and indicator lights permit the operator to control the functioning of the subsystem and inform him of the subsystem's operating status. The control panel is mounted in the same cabinet which contains the electromechanical assemblies and logic circuitry. The functions and condition indicators on the panel perform in the following manner.

CONTROL OR INDICATOR	FUNCTION
OFF	This control incorporates a yellow indicator. When depressed, it turns off power to the CTW. It is reset by depressing the ON pushbutton.
ON	This control incorporates a yellow indicator. When depressed, it causes alternating current to be applied to the subsystem. The subsystem remains on after the button is released provided the +20 dc voltage is present.
STANDBY	This control incorporates a blue indicator. When depressed it sets the subsystem into manual mode after any operation in progress has been completed. It is reset by means of the ON pushbutton. The blue indicator lights when the subsystem passes from automatic to manual mode, when the chad box is full, and when the subsystem is first turned on.
OPERATE	This control incorporates a green indicator. When depressed, it sets the subsystem in automatic mode, if no out-of-service conditions exist. The indicator is extinguished when the STANDBY pushbutton is depressed putting the system in manual mode, or when the OFF pushbutton is depressed.

CONTROL OR INDICATOR	FUNCTION
INPUT	This control incorporates a blue indicator. It can be used only when the subsystem is in Operate mode. When depressed it transfers control of the CTW to the operator, if the subsystem is available. The indicator is lit when the CPU issues an Input command. It is extinguished when: X-OFF is depressed at the keyboard; EOT is depressed; an overflow condition exists; or a Break Command is executed.
END OF BUFFER	This indicator is white. It begins to pulse when the 240th character position in the buffer is filled. It is extinguished for the same reasons as the INPUT indicator.
OVERFLOW	This indicator lights in red to notify the operator of an overflow condition. It lights when any character other than X-OFF has been depressed after the 255 th position in the buffer has been filled or when the character erase key (←) has been depressed with the buffer pointer at zero position.
FULL CHAD	This indicator lights in red whenever the subsystem passes into the Standby mode because the chad box is emptied and the subsystem goes into automatic mode.

CONTROL OR INDICATOR	FUNCTION
SEGE	This indicator lights in red under the following conditions: erroneous message; overflow condition; parity error; bit configuration does not represent a printer character, and buffer error check at end of transfer. The light is extinguished when either a Set Input or an Output instruction is executed.

PART IV. FUNCTIONAL DESCRIPTION

The subsystem may operate in either of two modes: off-line and on-line. For the sake of clarity, these modes are described in separate sections in this part of the manual. Also described are requests the operator can make of the system from the subsystem.

The echoplex operation and the types of interrupts sent to the CPU, are explained.

A. OFF-LINE OPERATION

When the subsystem is operating in the off-line mode, the STANDBY indicator is lit and the following operations can be performed:

- typing for printing
- typing for printing/punching
- reading tape for printing

Information may not be exchanged with the CPU and the subsystem may not leave this mode of operation through a CPU command.

B. ON-LINE OPERATION

In this operating mode, the OPERATE indicator is lit and information may be input and output using the subsystem.

1. Output of information

When the INPUT indicator is extinguished, the subsystem is not available for use by the operator; it functions only as an output device. Information is transferred from the CPU to the subsystem according to the following sequence of operations:

1) The CPU sends a data transfer command

2) The CTW101 goes into a busy state during the transfer of information from the CPU to the subsystem buffer.

3) When the buffer is full, printing and/or punching begins. The CPU is freed to executed other instruction; the subsystem remains in a busy state until all information in the buffer has been output.

4) When information from the buffer has been output, the subsystem is faced and an interrupt is sent by the subsystem to the CPU.
The interrupt is sent in the form of status signals INES, NU30, and NU20.

The message output may be equal to, longer, or shorter than the buffer length; that is the end of data transfer may be given from the CPU (end of message) and/or from the controller (buffer full).

5) At the end of the data transfer, the qualitative results of the operation may be detected by testing the Status Indicators and the updated data address, in the CPU.

   If a bit configuration sent from the CPU to the subsystem does not represent a character in the graphic set, no error is signalled, but the manner in which the invalid characters are handled is unknown.

   In output, unlike input transfers, the characters CARRIAGE RETURN and LINE FEED are a part of the message as they contribute to its length; they must therefore be properly set up by software.

   For sake of correct mechanical operation, they must be in the sequence CARRIAGE RETURN - LINE FEED.

2. Input of Information

Information is transferred from the subsystem to the CPU in the following sequence.

1) When the operator needs to send information to the CPU, he must depress the input pushbutton. This action causes an interrupt to be sent to the CPU.

2) When the CPU senses the interrupt, it issues a Set Input from CTW instruction. This instruction gives the operator control of the CTW101 and lights the INPUT indicator. The subsystem is now in a busy state; the IGOL status signal is present at the interface.

3) The operator may now begin filling the buffer from the keyboard. To indicate the end of the message, X-OFF must be depressed.

   Depressing X-OFF causes an interrupt to be sent to the CPU and the INPUT indicator to be extinguished.
   The subsystem is no longer in the busy state, and the IGOL status signal remains active to distinguish this interrupt from the one arising at the end of printing (see chapter 1).

4) When the CPU senses the interrupt, it issues the Input from CTW instruction. The subsystem is now in a busy state and the IGOL status signal is removed. During the transfer of information from the buffer to the CPU, the subsystem remains in a busy state.

During the time interval in which the subsystem is not busy but the buffer is full (IGOL status signal is present), the software will not permit an instruction other than the following to be issued;

Break
Input from CTW
Enable Clock
Inhibit Clock
Reset NU20 Interrupt

The latter instruction must be executed before the Input from CTW instruction. If an attempt is made to execute any instruction other than those listed, when IGOL is present, the instruction is ignored and the CAPE error status signal is issued.

If 255 positions are filled and any key other than X-OFF is depressed, the buffer full interrupt will be issued automatically with status signals SEGE, EGOL, and OVERFLOW at the control panel lights. There are issued for the following reasons:

SEGE informs the CPU of an erroneous operation
EGOL is issued for diagnostic purposes
and OVERFLOW indicator lights for the operator's information.

If an error is made while filling the buffer, EOT should be depressed to eliminate the possibility of transmitting an erroneous message. The end of buffer filling interrupt is generated accompanied by the SEGE status signal.

When one or more previously inserted characters are to be erased from the buffer, the operator should depress the ← key as many times as consecutive characters are to be erased.
Each time this key is depressed, it causes the buffer address printer to more to the previous character position. If this key is depressed more times than there are characters in the message, the SEGE, EGOL and OVERFLOW indicators will light.

If the last character in the message was typed incorrectly, the erase operation has no effect, an interrupt signal is sent to the CPU, and the SEGE, EGOL, and OVERFLOW indicators will light.

If any attempt is made to insert an illegal character either from the keyboard or paper tape, the attempt will be ignored, the bit configuration will not be placed in the buffer nor printed, and the SEGE status signal appears at the interface.

The LINE FEED and CARRIAGE RETURN bit configuration are not considered characters and do not enter the buffer. They cannot be sent to the CPU.

Any message input or output must contain at least one character. Any messages transferred from the buffer to the CPU are accompanied by an end-of-block character and an end-of-message signal.

C. OPERATOR REQUESTS

The operator assumes control by depressing the INPUT push-button. This can be done in any of the following circumstances:

a) If the unit is in Standby, before the operator must set the unit to OPERATE before depressing INPUT

b) If the unit is in Operate mode, is not transferring information, and the buffer is empty, depressing INPUT lights the INPUT indicator and causes the CPU to execute a Set Input from CTW instruction.

c) If the unit is in Operate Mode and either transferring information from CPU to buffer or printing information transferred from the CPU to the buffer and the operator depresses INPUT, an interrupt consisting of INES, NU30, NU 20, and NU10 is sent to the CPU. Control will be transferred to the subsystem when the operation is complete.

d) If the unit is in Operate mode and the INPUT indicator is already lit, an interrupt is sent to the CPU when the input operation is complete (i.e. after the buffer has been field from the keyboard) requesting control to be transferred to the subsystem.

e) If the unit is in Operate mode, the INPUT indicator is exstinguished and either buffer contents are being transferred to the CPU or with buffer full, the command to transfer its contents to the CPU has not yet arrived, the operation will be completed before control is transferred to the subsystem.

D. ECHOPLEX

The echoplex function inhibits printing of informations from the keyboard and acts as a substitute for a mechanical interlock for the keyboard.

Echoplex is enabled when the unit is in Standby mode or under control of the operator. When the unit is in Operate mode and under control of the CPU, or with a full buffer (PE00 and IGOL status signals present), the echoplex function is disabled.

The operator who attempts to use the keyboard with the unit in Operate mode and the INPUT indicator extinguished (therefore with buffer empty also) will recognize the condition by the absence of printing.

E. INTERRUPTS

Three types of interrupt are generated by the subsystem.
These are described separately in following paragraphs.

1. Interrupt caused by operator request

These signals include: INES; NU30; and NU10.
When the operator requests control over the Subsystem he must depress INPUT which generates an interrupt and causes the CPU to execute the Set Input from CTW instruction.

2. INES, NU30, NU20

Two sub-cases must be considered for this type interrupt. These are as follows:

a. Presence of IGOL at the interface

This interrupt signal is generated when the buffer has been filled from the keyboard or the paper tape reader. The CPU, when sensing this interrupt, shall issue an Input from CTW instruction.

b. Absence of IGOL at the interface.
This identifies an interrupt issued at the end of information transfer and printing.

3. INES, NU30, MAPE

These signals identify a clock interrupt. This interrupt may be issued even when the subsystem is not available to execute commands.

When the subsystem is in Standby mode, all interrupts, except for the clock interrupt, are masked by the controller.

PART V. PROGRAMMING

This part of the manual describes the machine language instructions which are available for programming the CTW101. It is intended primarily for programmers.

A. GENERAL

1. Software

Normally, no special routines for the use of CTW101 need be written by the programmer; standard subroutines exist in the subroutine library of the Operating System. However, should a special subroutine be required for a special purpose, it must be coded by the programmer. The following sections and paragraphs indicate the manner in which this may be done, by describing the individual instructions themselves.

2. Format of I/O instructions

The manner in which commands are transferred between CPU and subsystem is described in the appropriate system reference manual. This manual contains a brief summary of the Call Peripheral (PER) and Call Peripheral Indirect (PERI) instructions as an aid in explaining the functioning of the CTW101 subsystem.

The PER instruction is used inall GE-100 Line systems; the PERI instruction is used only with EDOS (Extended Tape Operating System). The difference between the two instructions is as follows:

In the PER instruction, the subsystem address is named directly;

In the PERI instruction, the subsystem address is retained in a fixed position in core store, and therefore need not be named in the instruction.

The User is referred to GE-100 Line Programmer's Manuals to have a detailed description of these instructions.

B. INPUT/OUTPUT INSTRUCTIONS

1. General

Input/Output instructions may be divided into two general categories: those that occupy the controller; and those that do not there are as follows:

Instructions that occupy the controller:

- Set input from CTW
- Input from CTW
- Output from CTW

Instructions that do not occupy the controller:

- Break
- Set Standby
- Reset NU10 Interrupt
- Reset NU20 Interrupt
- Enable Clock
- Inhibit Clock
- Reset Clock Interrupt

The CTW101 instructions will be individually described in the following chapters, where they will be divided, according to their structure, into Data Transfer instructions and Peripheral Control instructions.

2. Data Transfer

The field DELTA referenced by the PER or PERI instruction is six-octet long and formatted as follows:

$$Z\ X\ L_1\ L_2\ I_3\ I_4$$

where:

Z	specifies the mode of execution of the instruction, which is identified by X. The X values will be shown beside each instruction. For details on the code Z, please refer to the relevant GE-100 Reference Manual.
$L_1 L_2$	represents the length, minus one, of the field to be transferred.
$I_3 I_4$	represents the store address to or from which the data is to be transferred.

a. Input from CTW X = 00

This instruction moves the contents of the CTW101 buffer to the CPU. When the operator indicates that the message is complete by depressing X-OFF, the subsystem enters the free state with the IGOL status signal still present, and at the same time the interrupt signals INES, NU30, and NU20 are issued. Only under these conditions can an input transfer instruction be accepted; upon receiving it, the subsystem enters the busy state and the IGOL signal disappears. As a result, the buffer contents are transferred to the CPU. At the end of the transfer, the FINE status signal indicates that the subsystem is free to accept other commands.

b. Output to CTW X = 02

This instruction causes a message to be transferred from the CPU to the buffer. When execution of this instruction is initiated, the subsystem enters the busy state. The contents of the buffer are printed whenever the buffer is filled or when the "end" signal is issued by the CPU. When the transfer is finished, the subsystem is freed and generates the INES, NU30, and NU20 status signals without the presence of the IGOL status signal at the interface. In this manner, the end-of-printing interrupt is differentiated from the interrupt arising in the previous case (Input from CTW).

3. Peripheral Command

The field DELTA referenced by the PER o PERI instruction is two-octet long and formatted as follows:

Z X

where:

Z	specifies the mode of execution of the instruction, which is identified by X. The X values will be shown beside each instruction. For details on the code Z, please refer to the relevant GE-100 Reference Manual.

a. Set Input from CTW

This instruction gives the operator control og the subsystem. When the instruction is received, the controller enters the busy state, the IGOL signal is set at the interface, the INPUT indicator is lit at the console, and the echoplex capability is enabled. The subsystem is now at the disposition of the operator. Information may be entered into the buffer by means of the keyboard or the paper tape reader.

b. Break X = 03

This is a command issued by the CPU to remove the subsystem from control of the operator. This command is also accepted when the subsystem is under control of the operator (IGOL status signal is present at the interface) and when the buffer, filled from the keyboard is ready for an Input command, to empty it.

When this command is received, the buffer will be cleared and the INPUT indicator will be extinguished. This command is issued immediately. That is, without waiting for the subsystem to enter the available state and is also accepted when the subsystem is in the process of printing information after an Output data transfer.

c. Set Standby X = 0C

This command sets the subsystem in Standby mode (i. e. off-line).

d. Reset NU10 Interrupt X = 06

This command is sent from the CPU to reset the interrupt consisting of INES, NU30, and NU10 status signals. This command must be issued before a Set Input from CTW instruction is executed.

e. Reset NU20 Interrupt X = 07

This command is sent from the CPU to reset the interrupt consisting of INES, NU30, and NU20 status signals. This command must be issued before an Input from CTW instruction can be executed.

f. Reset Clock Interrupt X = 05

This command is sent from the CPU to reset the interrupt signal generated by the clock, and is also accepted when the subsystem is in the busy state.

g. Enable Clock X = 08

The clock in the subsystem issues an interrupt to the CPU every 20 msec. The command to enable this interrupt can be accepted regardless of the operating date of the subsystem.

h. Inhibit Clock X = 0A

The interrupt issued by the subsystem clock every 20 msec is inhibited after execution of this command. This command is accepted regardless of the operating state of the subsystem.

C. TIMING INFORMATION

The subsystem will transfer information at varying rates, depending on the type of transfer. Since the transmission of information is asynchronous, information transfer always proceeds at the maximum possible speed. Information transfer speeds for various phases are as follows:

Buffer loading from the keyboard or paper tape
10 characters or 110 bits per second.

Transfer of buffer information to the CPU
4, 2 μsecs per character.

Transfer of CPU information to the buffer
5, 3 μsecs per character.

Emptying the buffer by printing
10 characters per second.

PART VI. OPERATING PROCEDURES

This part of the manual describes normal operating procedures which are generally the responsibility of the operator.

A. MECHANICAL PROCEDURES

1. Loading and unloading paper tape for reading

Position the control to FREE
Lift the tape lid
Insert the paper tape in the guide, ensuring that it comes; into engagement with the sprocket
Close the tape lid

To unload the paper tape simply lift the tape lid and remove the tape.

2. Loading and unloading paper tape for punching

Depress the RELEASE pushbutton
Lift the cover
Position the tape in the bracket in such a way that the drive mechanism may properly engage the tape
Depress the ON pushbutton after closing the cover
Print and punch the CR configuration a number of times to ensure that the tape is being properly fed to unload the paper tape, simply lift the cover and remove the tape.

B. CTW101 START-UP

To put the subsystem into operation, the operator must depress the ON pushbutton. Then, if CTW to CPU on-line connection is desired, he must depress the OPERATE pushbutton; on the other hand, if he wants to punch a message, with the subsystem in standby, the operator must depress, first ON, then STANDBY.

APPENDICES

A. CTW101 STATUS SIGNALS

This appendix provides various types of information related to status signals generated using the CTW101.

1. PE00 - Subsystem available

Description of this status signal into phases of input and output to assist in the understanding of its occurrence.

a. Input

This signal is issued when the Set Input From CTW instruction is executed and is extinguished at the end of transfer of information, when the buffer is filled. The end of transfer can be signalled by any of the following conditions: X-OFF key is depressed; EOT key is depressed signalling an erroneous message; or an overflow condition occurs.

The PE00 status signal can be reset by execution of BREAK instruction. After the buffer has been filled, PE00 is set by an Input from CTW instruction and is reset at the end of the transfer.

The unit is not available at this time and only the Break instruction can be accepted.
The PE00 signal appears also when the unit is out of service.

b. Output

The PE00 signal is set by the Output to CTW instruction and is removed only after the buffer contents have been printed. In this phase the unit is not available, no instructions are accepted.
The PE00 signal appears also when the unit is out of service.

2. IGOL Input Interrupt

This status signal is issued only during input information transfers and is used to distinguish the two types of INES, NU30, and NU20, interrupts: at the end of buffer loading and at the end of printing.

This signal is issued when the Set Input From CTW command is executed. It is not removed when the buffer is filled but rather when the command Input from CTW is executed. The interval of time between the end of buffer filling and the arrival of the Input from CTW command can be recognized by the presence of IGOL and the absence of PE00. The only commands that can be accepted at this time are Break, Input from CTW, and Reset NU20 Interrupt.

3. CAPE Command Error

This status signal is set for any of the following reasons:

The controller is occupied and a command other than Break has been received.

The controller is in Standby mode and a command has been received.

A command containing an odd parity error has been received.

An Input from CTW command has been received with the buffer empty, that is before any operator's request and before a Set Input from CTW command.

The buffer is full (IGOL is present and PE00 is absent) and a command other than Input from CTW, Break or Reset NU20 Interrupt has been received.

The signal is removed whenever execution of a new command begins.

4. ERCA Output Check Error

This signal is present whenever an error occurs in transferring data or commands from the CPU. In such a case, this signal is accompanied by the CAPE signal. It is removed when the next command arrives.

5. SEGE OR of Status Signals

a. During Input

1) When the buffer is being loaded from the keyboard of the paper tape reader, the SEGE signal is issued under the following circumstances:

The EOT key is presset to indicate on erroneous message.

An overflow condition exists

A bit configutation is recognized as not representating a valid character: valid characters are those included in the printing set, plus the functions LINE FEED, CARRIAGE RETURN, X-OFF, and EOT.

An error has been found in characters arriving from the subsystem.

In these circumstances, the SEGE signal is only significant when accompanied by the NU20 interrupt.

2) Buffer to CPU transfer

SEGE is issued when a parity check error is found in data leaving the buffer, after the transfer is terminated.

b. During output

The SEGE signal is set when a parity check error is recognized in output from the buffer, is is issued at the end of printing.

The SEGE status signal is reset whenever a Set Input from CTW or Output to CTW command is received.

6. MARE Out Of Service

This status signal is set under the following circumstances:

When the subsystem is in OFF

When the chad boy is full and the subsystem is available. In this case, the subsystem enters the Standby mode.

The signal is reset under the following circumstances:

The ON pushbutton is depressed.

When the chad box is emptied and the OPERATE pushbutton is depressed.

7. SECO Standby

This signal is set when:

Any of the causes that set the MARE signal is present.

When the STANDBY pushbutton is depressed.

When the set Standby instruction is executed.

This signal is reset by depressing OPERATE, after removing the causes of the Standby condition.

8. INES Interrupt

This signal is set in the following circumstances:

With NU30 and NU10, when the operator depresses the INPUT pushbutton.
With NU30 and NU20, at the end of buffer filling in the input phase (X-OFF, EOT, OVERFLOW).
With NU30 and NU20, at the end of information transfer and printing.
With NU30 and MAPE when a clock interrupt exists.

9. MAPE Clock Interrupt

This signal indicates the presence of a clock interrupt.
It is set by the Enable Clock command, no matter what operating mode the subsystem is in.
It is reset by the Reset Clock Interrupt command.

10. NU10, NU20, Type of Interrupt

The NU10 and NU20 signals specify the type of interrupt.

11. NU30 CTW101 Interrupting

The NU30 signal identifies the interrupting subsystem (in this case the CTW101).

12. EGOL Buffer Overflow

This signal indicates on overflow condition in the controller.
It is reset by pressing either OPERATE, or CLEAR (on the CPU console).

13. FINE End of Transfer

This signal is set during buffer-to-CPU transfers, under the following conditions:

The IS7 character configuration (ASCII code = F1 esadec.) is read in the buffer. This configuration is introduced by means of the X-OFF of EOT functions.
When the contents of the 255th buffer position are transferred regardless of whether the X-OFF function has been introduced.

B. ASCII (ISO) CODE, EXPANDED TO 8 BITS

					0	1	2	3	4	5	6	7	8	9	A 10	B 11	C 12	D 13	E 14	F
				h	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				g	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				f	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
	d	c	b	e	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
0	0	0	0	0							0	0	@	P						
1	0	0	0	1							!	1	A	Q						
2	0	0	1	0							"	2	B	R						
3	0	0	1	1							#	3	C	S						
4	0	1	0	0							$	4	D	T						
5	0	1	0	1							%	5	E	U						
6	0	1	1	0							&	6	F	V						
7	0	1	1	1							'	7	G	W						
8	1	0	0	0							(	8	H	X						
9	1	0	0	1							)	9	I	Y						
A 10	1	0	1	0	LF						*	:	J	Z						
B 11	1	0	1	1							+	;	K	[						
C 12	1	1	0	0							,	<	L	\						
D	1	1	0	1	CR						−	=	M	]						
E	1	1	1	0							.	>	N	↑						
F	1	1	1	1		S7					/	?	O	→						

C. PHYSICAL CHARACTERISTICS

The dimensions of the CTW101 subsystem are:

27,7 x 27,7 x 38,3 in.
(703 x 703 x 985 mm).

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Multi-line Controller
MLC104

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GE-100 Line

Multi-line Controller MLC104

OCTOBER 1970

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PREFACE

This manual has been produced by Honeywell Information Systems Italia. The terminology used in this manual is according to the International Federation for Information Processing and the International Computation Centre (IFIP/ICC) Vocabulary of Information Processing.

Suggestions and comments pertaining to form, content, purpose, or use of this manual are invited. Comments may be sent on the Document Review Sheet which appears at the rear of this manual.

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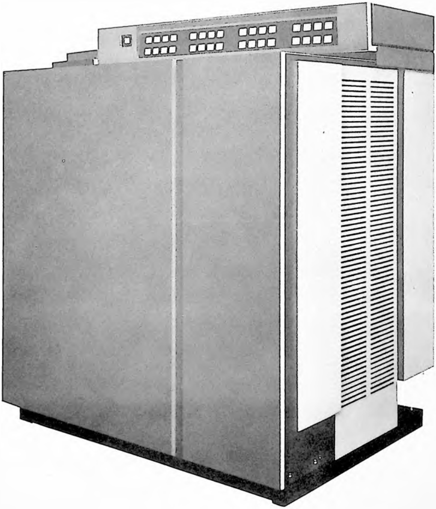


MLC104 Multi-Line Communications Controller.

INTRODUCTION

This manual describes the MLC104, Multi-Line Communications Controller for use with systems in the GE-100 Line. It is intended for use by analysts/ programmers and operators as a reference manual but may also be used for other purposes such as training, etc.

The manual contains the following specific divisions of information:

General description.

Format of data transmitted and received and the transmission codes used.

Description of hardware components as related to programming and operator oriented procedures.

Functional description of MLC104 operation during processing.

Programming I/O instructions for special purpose routines.

Appendices contain such supplementary information as: brief descriptions of line controllers and line terminators; transmission codes; status signals; and physical characteristics of the equipment.

PART I. - GENERAL DESCRIPTION

A. DEFINITION AND OBJECTIVES OF MLC104

The MLC104 (Multi-Line Controller 104) is a modular subsystem in a position to handle up to 16 transmission lines simultaneously active.
It can be used with the GE-100 Line systems and it is ideally suited for teleprocessing applications, such as:

- Data collection and distribution for central agencies, such as finance companies, which have many branch offices;
- Message switching, to enable remote locations to communicate with each other through a central location;
- Inquiry and Information Retrieval, which provide many users with simultaneous access to large amounts of stored data.

Each line is suitable for point-to-point connections between the CPU and one terminal or for multi-point connections between the CPU and several terminals. Each line may be either telegraphic or telephonic, public or private, and switched or not.

The MLC104 is capable of handling any four of ten possible transmission speeds: 45.5, 50, 75, 110, 134.5, 150, 200, 300, 600, and 1200 bps (bit per second). Each line may use any of the four selected speeds, which are fixed ad installation time.
Transmission codes which may be used are the 7+1 bit ISO code or the 5 bit Baudot code.

The MLC104 can be attached to connection 3 and/or 4 of the GE-100 Line Systems.

If an MPA (Multiple Peripheral Adapter) is used, up to four MLC104 subsystems may be attached to each connector.

B. HARDWARE CONFIGURATION

1. MLC104 Components

The structure of the subsystem includes three major classes of components:

- a basic module, which performs the basic functions of the subsystem (MLC - Multi Line Controller)
- up to four control modules, one of which housed in the basic module (LCA - Line Controller Asynchronous)
- end line modules, different in accordance with line types and modems employed (LTA - Line Terminator Asynchronous).

The basic module of the MLC104 consists of a line controller, operator console, 4096-position core store, and the associated power supplies, ventilation equipment, circuitry, etc.

Since each control module can handle up to four lines, the overall capability of one MLC104 is of 16 transmission lines.

These can be used individually in half duplex mode for TWA (Two Way Alternate) transmissions or in pairs in full duplex mode for TWS (Two Way Simultaneous) transmissions, according to one of the following specifications:

- 4 TWA transmissions per control module
- 2 TWS transmissions
- 1 TWS and 2 TWA transmissions

The line controllers share the 4096-position core store of the MLC104, but each line controller has an individual portion of the (single) operator's control panel.

When the MLC104 has a full complement of three additional line controllers, there is no requirement that all controllers must be configured for the same type of transmission. That is, they all need not be used for either TWA or TWS transmission. The only restriction is that transmission lines paired for TWS transmission be attached to the same line controller. The following diagram illustrates this by showing a typical arrangement where the same MLC104 is used in both full duplex and half duplex transmission modes.

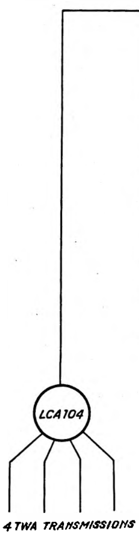


Figure 1. MLC104 Modular Structure.

Each transmission line is connected to the MLC104 through a dataset, line terminator and line controller. A more detailed description of the function of these components appears in Part III of this manual.
The type of line terminator used varies with the dataset used, transmission speed, transmission type (TWA or TWS), transmission mode (synchronous or asynchronous), etc. A list of some of the line terminators that may be used with the MLC104 appears in Appendix B.

Line controllers also vary in type, depending on whether the transmission mode is synchronous or asynchronous. Appendix B of this manual also lists some line controllers that can be used with the MLC104.

The core store unit in the MLC104 is divided for use as line buffer for each individual transmission line connected. If eight or fewer lines are connected, each buffer may be as long as 510 character positions; if more than eight lines are connected, effective buffer length is 254 character positions for each transmission line. Briefly, the buffers are used to save space in the CPU by storing information being transmitted or received at the line controller. The use of buffers permits overlapping, saving execution time in the CPU. With the buffer, each transmission line assumes the operating manner of a completely buffered subsystem. The buffer, and its functioning, is more completely described in Part III of this manual.

2. Datasets

The dataset is a device responsible for conversion of binary digital data to and from electrical signals by modulating or the modulating a carrier wave. A dataset may also be called a modem.

Any dataset used with the MLC104 must conform to the CCITT or EIA RS232B interface specifications for such devices.

Many various types of datasets may be used, depending on requirements. The following is only a partial list:

Bell 103
ARE
SELENIA
ITT GH2002
Olivetti TD2200
Bell 202

For additional information regarding the functioning of any of these devices, the appropriate reference manual should be consulted.

C. SOFTWARE ENVIRONMENT

The MLC104 is designed to operate under EDOS (Extended Disc Operating System). Subroutines necessary to implement MLC104 functions are stored in the EDOS subroutine library. These MLC104 functions are described in this manual; for additional information regarding EDOS, refer to the appropriate reference manual.

D. TRANSMISSION CHARACTERISTICS

1. Transmission modes

Transmission may be in either of two modes: half duplex, which permits transmission in forward or backward direction alternately; and full duplex, which allows transmission in forward and backward directions simultaneously. Transmission can also be identified by type: TWA (Two Way Alternate) is half duplex transmission and requires one transmission line; TWS (Two Way Simultaneous) is full duplex transmission and requires a pair of transmission lines.

Line controllers vary for a number of reasons, one of these being whether transmission is synchronous or asynchronous.

The difference between the two transmission types is as follows.

Synchronous transmission is such that between any two significant instants there is always an integral number of unit intervals. The transmission is slaved to a clock, which provides a constant accurate pulse rate. Asynchronous transmission is a process in which each group of code elements (i.e. each character) is always blocked up between one START element and one (or more) STOP element. Bit and character synchronization is initialized by recognition of the beginning of the START element and is stopped when receiving the last element of the elementary block. In this second case between two significant elements located in different characters there is not an integral numbers of unit intervals.

TWS transmission uses two lines of the controller - one for reception and one for transmission. These lines are paired according to a specific numbering system. Assuming a fully complemented MLC104, that is with three additional line controllers and 16 transmission lines, the pairing of lines for TWS transmission is as follows:

TRANSMISSION	RECEPTION
00	02
04	06

TRANSMISSION	RECEPTION
08	10
12	14
01	03
05	07
09	11
13	15

2. Transmission speeds

In synchronous transmission, transmission speed depends on the type of dataset being used. In asynchronous transmission, the MLC104 is adjusted for information transmission at any four of the following ten speeds: 45.5; 50; 75; 110; 134.5; 150; 200; 300; 600; or 1200 bits per second. This adjustment is fixed at the time of installation of the MLC104.

3. MLC104 to dataset interface

The MLC104 to dataset interface is as prescribed by international standards for such interface. They are:

C.C.I.T.T.

E.I.A. RS232B

All circuitry used for transmitting and receiving purposes is according to internationally defined standards regarding electrical voltage and impedance values.

Codes which may be used in transmitting these signals are the five-bit-per-character Baudot code or the 7 + 1 bit-per-character ISO code, as selected by the program in execution. In reference to the ISO code, the + 1 refers to the parity bit.

PART II. - FORMAT OF DATA

This part of the manual is intended for the use of both operators and programmers. It describes the data formats used in processing of information by the MLC104. Individual subjects include: the format of messages; any special characters required or normally used such as message ending characters, check characters, etc.; and the transmission codes used, including the code compression and expansion required when data is transferred between the CPU and transmission lines.

A. DATA MESSAGES

1. Asynchronous operation

a. General

Messages processed by the MLC104 can be divided into two types for purposes of discussion: those being transmitted (from the CPU to transmission lines); and those being received (by the CPU from the transmission lines).

b. Messages being transmitted

Messages being transmitted are not required to be in any special format. Other than making a parity check, if required, on characters transferred from the CPU to the MLC104, no checks are made nor are controls imposed on the configuration of messages transferred into the buffer of a specific transmission line.

Messages being transmitted may be considered to be of three types: those whose length does not exceed the capacity of the trasmission line buffer; those whose length does exceed the capacity of the transmission line buffer; and those which are to be retained in the buffer with a message in response or queued in the buffer. The method by which processing of each of these type messages proceeds is described in Part IV of this manual.

One note regarding the length of messages to be transmitted is extremely important. Messages to be transmitted in ISO 7 + 1 bit code may exceed the capacity of a transmission line buffer; messages to be transmitted in Baudot 5 bit code may not exceed the capacity of a transmission line buffer. Also, for the latter code, figure-shift and letter-shift characters must be considered as occupying character positions in the buffer.

c. Messages being received (those sent from the MLC104 to the CPU) must be of a type and transmission mode that may be processed by the line controller at the transmission line in question.
For example, a line controller which is designed to receive information at a maximum rate of 300 bits per second cannot process information arriving at 1200 bits per second.

There are various ways to signal the end of a message to the MLC104. However, the line controller must be prepared to recognize the specific type character or characters to be used so that the CPU may be signalled that an entire message has been received. These characters are described in following sections in this part of the manual.

The length of the message declared by the user in the transfer instruction must be always equal to or greater than the capacity of the buffer (254 or 510 chars.). This is to clear the buffer correctly and to avoid errors in the next transfer to the CPU.

B. SPECIAL CHARACTERS

1. Standard end of message characters

A number of characters have been designated according to international standards (ISO, ECMA, USASCII) as signifying the end of a message. These characters are recognized by the MLC104 as the following: ETX; ETB; EOT; ENQ; ACK; and NACK. The bit configuration and hexadecimal equivalent of each of these characters is listed in Appendix C in this manual.

If any of these characters is received by the CPU, followed by the BCC character, an interrupt signifying an end of message condition is sent to the CPU.

2. Specially designated end of message characters

The MLC104 also has the capability to associate an end of message indication with a normal character in the character set, giving it a special significance. This character may be designated by means of the Set Special End Character instruction, and is transferred to the last position of the buffer of the transmission line addressed. When a message is received, each character coming into the buffer is compared to this specially designated end character. If any comparison results in an equal condition, an end of message interrupt is sent to the CPU.

This procedure, of setting a normal character as a special end character is useful in the case of those terminals which are incapable (by design) of sending special end characters to the MLC104. In programming this capability however, special care must be exercised that a character not normally present in the type messages being sent is set as the special end character. Otherwise, premature end of message signals may be generated.

3. Pause characters

At various times during the transmission of information from the CPU to certain electromechanical devices, a time pause is necessary to permit the device to execute a mechanical operation which may not be performed while information is being transferred or requires a time duration to accomplish which is longer than that required to transfer one character. An example of such an operation might be a carriage shift on a typewriter type terminal.

In cases involving the ISO 7 + 1 bit code, the control character transmitted which effects this pause is SYN, whose hexadecimal configuration is 16. In cases involving the Baudot 5 bit code, redundant figure-shift or letter-shift characters are transmitted.

C. CHECK CHARACTERS

The special check character encountered in MLC104 processing is the Block Check Character, BCC. This character is associated with a block of information for the purpose of checking the absence of an error within the block during transfers of the information.

Specifically, the BCC character is used in a longitudinal check on the total number of bits (excluding the parity bit) of a block of characters.

For additional information regarding this character, refer to an appropriate text on character transmission conventions.

D. TRANSMISSION CODES

1. General

In using the MLC104, two codes are used for the transmission of information: the 5 bit Baudot telegraphic code and the 7 + 1 bit ISO code. In the CPU store, information is retained in the manner normal to computer systems in the GE-100 Line. That is, in an 8 bit configuration with one odd parity bit.

During transfers of information between transmission lines and the CPU, the bit configurations of the characters must be altered by means of a code expansion or compression. Characters received for transfer to store must be expanded into an 8 + 1 bit configuration which is then translated into the store configuration. Characters in the 8 + 1 bit store configuration must be converted to the 7 + 1 or 5 bit configuration required in the transmission lines.

Code conversion from the 8 + 1 expanded ISO code or the 8 + 1 expanded Baudot code to the 8 + 1 bit store configuration (and vice-versa) must be performed by software. Code expansion and compression is performed by hardware in the following manner.

2. Code compression: 8 + 1 bit store to 7 + 1 bit ISO

8 + 1 bit core store format

Odd parity bit	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
K	H	G	F	E	D	C	B	A

7 + 1 bit ISO format

Parity bit	2^6	2^5	2^4	2^3	2^2	2^1	2^0
M	H	G	E	D	C	B	A

Where the value of M can be as follows:

- fixed $\left\{\begin{array}{l}0\\1\end{array}\right.$
- calculated $\left\{\begin{array}{l}\text{odd parity bit}\\\text{even parity bit}\end{array}\right.$

according to the specification established by the user in the Option Register.

M is calculated, if required, as follows:

- odd parity bit : $M = K \bullet \bar{F} + \bar{K}\, F$
- even parity bit : $M = K \bullet F + \bar{K} \bullet \bar{F}$

where $\bullet$ = logical AND
$+$ = logical OR

Example:

character in core store	1	0	1	1	1	1	1	0	1
	K	H	G	F	E	D	C	B	A
7 + 1 bit ISO character			0	1	1	1	1	0	1
		M	H	G	E	D	C	B	A

odd parity bit : $M = K \bullet \bar{F} + \bar{K} \bullet F = 1 \bullet 0 + 0 \bullet 1 = 0 + 0 = 0$

even parity bit : $M = K \bullet F + \bar{K} \bullet \bar{F} = 1 \bullet 1 + 0 \bullet 0 = 1 + 0 = 1$

3. Code expansion: 7 + 1 ISO to 8 + 1 bit expanded

7 + 1 bit ISO format

Parity bit	2^6	2^5	2^4	2^3	2^2	2^1	2^0
M	G	F	E	D	C	B	A

8 + 1 bit expanded format

Parity bit	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
K	G	F	G	E	D	C	B	A

The value of K is fixed (either 0 or 1) or calculated, according to the specification established by the user in the Option Register. When the character is moved from the line buffer to the CPU, the parity bit will always be odd. The list of ISO symbols and their expanded 8 + 1 bit equivalents is shown in Appendix C of this manual. Conversion from 8 + 1 bit expanded code to the normal GE-100 Line core store configuration is performed by software.

4. Code compression: 8 + 1 bit store to 5 bit Baudot

8 + 1 expanded format

Parity bit	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
K	L	G	F	E	D	C	B	A

5 bit Baudot code format

2^4	2^3	2^2	2^1	2^0
E	D	C	B	A

The LGF configuration in the 8 + 1 bit store code can be either 101 or 010. At any time that the contents of the LGF core store bit positions vary from 101 to 010 or vice-versa, the FIGURE-SHIFT or the LETTER-SHIFT characters are respectively issued prior to sending the character(s) proper.

Remember that the 8 + 1 store code must be converted to the 8 + 1 expanded Baudot by software before the compression: the contents of LGF do not vary during conversion (see Appendix D).

5. Code expansion: 5 bit Baudot to 8 + 1 bit expanded

5 bit Baudot code format

2^4	2^3	2^2	2^1	2^0
E	D	C	B	A

8 + 1 bit expanded code format

Parity bit	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
K	L	G	F	E	D	C	B	A

The parity bit is fixed (either 0 or 1) or calculated, according to the specification established by the user in the Option Register. When the character is moved from the line buffer to the CPU, K will always be an odd parity bit.

The LGF configuration is determined by receipt of a figure-shift or letter-shift control character. Following a letter-shift character, the LGF bit positions in the 8 + 1 expanded code character are filled with 101. This applies to all characters received until the next figure-shift character is received, after which the LGF positions are filled with 010, etc.

6. 8 + 1 bit store configuration

Conversion between the 8 + 1 bit expanded code and the 8 + 1 bit core store code is performed by software. The 8 + 1 bit expanded code binary and hexadecimal equivalents of 7 + 1 bit ISO characters appear in Appendix C of this manual; for the 5 bit Baudot code, 8 + 1 bit expanded code equivalents appear in Appendix D. The normal 8 + 1 bit core store configuration of characters used in the GE-100 Line is as follows:

PRINTER CHARACTER	BINARY CONFIGURATION	HEXADECIMAL CONFIGURATION
0	0100 0000	40
1	0100 0001	41
2	0100 0010	42
3	0100 0011	43
4	0100 0100	44
5	0100 0101	45
6	0100 0110	46
7	0100 0111	47
8	0100 1000	48
9	0100 1001	49
[	0100 1010	4A
#	0100 1011	4B

PRINTER CHARACTER	BINARY CONFIGURATION	HEXADECIMAL CONFIGURATION
@	0100 1100	4C
:	0100 1101	4D
>	0100 1110	4E
?	0100 1111	4F
b̸	0101 0000	50
A	0101 0001	51
B	0101 0010	52
C	0101 0011	53
D	0101 0100	54
E	0101 0101	55
F	0101 0110	56
G	0101 0111	57
H	0101 1000	58
I	0101 1001	59
&	0101 1010	5A
.	0101 1011	5B
]	0101 1100	5C
(	0101 1101	5D
<	0101 1110	5E
\	0101 1111	5F

PRINTER CHARACTER	BINARY CONFIGURATION	HEXADECIMAL CONFIGURATION
↑	1010 0000	A0
J	1010 0001	A1
K	1010 0010	A2
L	1010 0011	A3
M	1010 0100	A4
N	1010 0101	A5
O	1010 0110	A6
P	1010 0111	A7
Q	1010 1000	A8
R	1010 1001	A9
-	1010 1010	AA
$	1010 1011	AB
*	1010 1100	AC
)	1010 1101	AD
;	1010 1110	AE
'	1010 1111	AF
+	1011 0000	B0
/	1011 0001	B1
S	1011 0010	B2
T	1011 0011	B3

PRINTER CHARACTER	BINARY CONFIGURATION	HEXADECIMAL CONFIGURATION
U	1011 0100	B4
V	1011 0101	B5
W	1011 0110	B6
X	1011 0111	B7
Y	1011 1000	B8
Z	1011 1001	B9
←	1011 1010	BA
,	1011 1011	BB
%	1011 1100	BC
=	1011 1101	BD
"	1011 1110	BE
!	1011 1111	BF

NOTE: The parity bit is always odd.

PART III. - MLC104 DESCRIPTION

A. INDIVIDUAL COMPONENTS

The components of the MLC104 subsystem are as follows: controller; power supplies; ventilation module; console; console cabinet. A short description of these units follows; physical dimensions appear in Appendix F of this manual.

The controller consists of a 4096 character core store and the electrical circuitry to transfer data between the CPU, its own store, and the transmission lines.

The power supplies furnish the current necessary to operate the controller circuitry, the indicator lamps at the console, etc.

The ventilation module provides the cooling required to keep the electrical circuitry at its proper operating temperature.

The console indicates the present operating state of the interface with the datasets and permits the operator to enable/disable individual transmission lines. The basic MLC104 uses one console; for each LCA added to the subsystem, an additional console is added. An MLC104 subsystem which includes the maximum complement of three LCA's uses a total of four consoles. The console (or consoles) is mounted in the free-standing console cabinet.

B. ELECTRONICS

1. General capabilities

The MLC104 provides the interface with computer systems in the GE-100 Line. Specifically, it has the following characteristics:

It can control four transmission lines operating in TWA (Two Way Alternate) mode or two transmission lines operating in TWS (Two-Way Simultaneous) mode. In effect, each LCA can simultaneously control four TWA transmissions or two TWS transmissions.

It is possible to augment the control capability of the MLC104 up to a maximum of 16 transmission lines for TWA operation or 8 transmission lines for TWS operation. This is accomplished by adding up to three additional line controllers, each with a transmission line complement the same as that of the basic MLC104: four transmission lines for TWA operation or two transmission lines for TWS operation.
Thus, an MLC104 with its maximum complement can simultaneously control 16 TWA transmissions or 8 TWS transmissions.

The MLC104 contains a 4096 position core store which provides each transmission line with a 510 position buffer if the number of lines connected is eight or fewer, or 254 position buffer in the number of lines connected is 9 to 16.

It receives or transmits data over telegraphic or telephonic transmission lines, in asynchronous mode, at any four of ten possible velocities ranging from 45.5 bits per second to 1200 bits per second.

It converts automatically between the 8 + 1 bit core store character configuration used in the GE-100 Line and either 7 + 1 bit ISO code or 5 bit Baudot code in both transmission and reception.

It controls the transmission of messages of various types. For example: those in which an end is signalled by standard or special characters supplied by programming; those in which an end is indicated by means of a Break signal; those of a non-standard type or those which exceed the capacity of the transmission line buffer; and those in which a message and a response to the message are to be stored in a line buffer at the same time.

These characteristics are inherent in the MLC104 by means of its specific capabilities which include: decoding of CPU instructions and issuance of data transmit/receive commands; ability to check incoming and outgoing messages; scanning of transmission lines to select the line addressed by the CPU; code compression and expansion; ability to transmit bits serially towards the dataset and in parallel towards the CPU; and the transmission of status signals to the CPU. For a more extensive description of the status signals, refer to Appendix E.

2. Options registers

a. Number and division of options registers

Each line controller contains four options registers, one for each transmission line. Each options register is seven bits long and may be considered as being divided into two parts:

bit positions 2^0 to 2^3 controlling options which apply in common to all the transmission lines connected to the line controller;

and bit positions 2^4 to 2^6 which control options which may be selected differently for each of the transmission lines connected.

The options that apply to all lines connected to the line controller are: whether transmission code used is ISO 7 + 1 bit or Baudot 5 bit; whether one or two bit positions are required to identify a stop condition; whether or not parity will be checked during transmission; and if parity is to be odd or even.

The options that apply to individual lines deal with the type of interrupts which must be expected and the reasons of such interrupts

b. Loading the options registers

The options registers are filled by means of the Set Options Register instruction. Programming of this instruction is described in Part V of this manual. In programming this instruction, the specific line whose individual options are to be changed is addressed in the instruction. If however, the bit positions that apply to the line controller are also changed, this change will apply to all lines connected to the line controller.

c. Significance of register bit positions

The significance of the contents of each bit position in the options register is as follows:

BIT POSITION	CONTENTS	INDICATES
2^0	0	Baudot 5 bit code is used

BIT POSITION	CONTENTS	INDICATES
2^0	1	ISO 7 + 1 bit code is used.
2^1	0	One bit is used to identify the STOP condition.
	1	Two bits are used to identify the STOP condition.
2^2	0	Parity check required.
	1	Transmission proceeds without a parity check.
2^3	0	If the content of bit position 2^2 is 1, the parity bit content is fixed at 0; if the content of bit position 2^2 is 0 an odd parity bit is requested
	1	If the content of bit position 2^2 is 1, the parity bit content is fixed at 1; if the content of bit position 2^2 is 0, an even parity bit is requested.
2^4	0	No interrupts
	1	Interrupts which are initiated by a special end of message character are accepted.

BIT POSITION	CONTENTS	INDICATES
2^5	0	No interrupts
	1	Interrupts which are initiated by a standard end of message character are accepted.
2^6	0	No interrupts
	1	Interrupts which are initiated when an alert level is reached in the buffer are accepted.

3. Buffer

a. Buffer division

Each MLC104 unit contains a 4096 character position core store which is divided into parts , used as buffers for the individual transmission lines connected to the MLC104. When 9 to 16 transmission lines are connected, the length of each buffer is 254 character positions, or octets. When 8 or fewer transmission lines are connected, the buffer may be divided, under program control, to provide 510 character positions for each transmission line buffer. The instruction which accomplishes this division is the Divide Buffer instruction which is described in Part V of this manual.

b. Buffer augmentation and line addressing

This increase in the size of each transmission line buffer is accomplished by assigning the line buffers of the eight unused lines to use by the lines which are connected. This is accomplished in the following pairing:

LINE BUFFER OF LINE	IS AUGMENTED BY LINE BUFFER OF LINE
0	1
2	3
4	5
6	7
8	9
10	11
12	13
14	15

This list assumes that the MLC104 has a complete complement of line controllers and 16 transmission lines connected. When this is the case, the lines are addressed in the following manner:

In the basic MLC104 with 4 transmission lines connected, the line numbers are : 0; 2; 4; and 6.

In the first additional line controller, the transmission lines are numbered: 8; A; C; E.

In the second additional line controller, the transmission lines are numbered: 1; 3; 5; and 7.

In the third additional line controller, the trasmission lines are numbered: 9; B; D; and F.

c. Buffer positions and line addresses (16 lines)

The arrangement of lines, line numbers, buffer store positions, etc. when 16 lines are connected is as in the following list.

CPU ADDRESS	PHYSICAL LINE NO.	STORE POSITIONS	
		FROM	TO
0	1	0	255
1	9	256	511
2	2	512	767
3	10	768	1023
4	3	1024	1279
5	11	1280	1535
6	4	1536	1791
7	12	1792	2047
8	5	2048	2303
9	13	2304	2559
A	6	2560	2815
B	14	2816	3071
C	7	3072	3327
D	15	3328	3583
E	8	3583	3839
F	16	3840	4095

This list indicates that each buffer contains 256 nine bit character positions (8 character bits plus one parity bit). However, two characters in each buffer are used by the equipment as indicators for service conditions, etc. so that each buffer contains 254 character positions which may be used in the transfer of information.

d. Buffer positions and line addresses (8 lines)

When eight or fewer transmission lines are connected to the MLC104, the effective size of each line buffer may be doubled by use of the Divide Buffer instruction. The programming of this instruction is explained in Part V of this manual. After execution of this instruction, the buffer is divided into eight parts rather than 16 and has the following configuration:

CPU ADDRESS	PHYSICAL LINE NO.	STORE POSITIONS	
		FROM	TO
0	1 - 9	0	511
2	2 - 10	512	1023
4	3 - 11	1024	1535
6	4 - 12	1536	2047
8	5 - 13	2048	2559
A	6 - 14	2560	3071
C	7 - 15	3072	3583
E	8 - 16	3583	4095

As when the buffer is divided into 16 parts, each line buffer requires two character positions for internal use by the equipment. Thus, although each buffer contains 512 actual character positions only 510 positions may be used for the transfer of information.

e. Clearing buffers

To clear the transmission line buffers, a Reset Break instruction must be issued for all the transmission lines connected. The General Reset instruction will not clear the buffers. For additional information regarding the programming of these instructions, refer to Part V in this manual.

4. Line controllers

a. Function

The line controllers used with the MLC104 have a variety of functions. They act as an interface device between the MLC104 and the transmission lines themselves. Appendix B in this manual lists some examples of line controllers that may be connected to the MLC104.

b. Adjustment for transmission speed

Different type line controllers are required for synchronous and asynchronous transmission. Line controllers used for asynchronous transmission may be adjusted at time of installation for reception of information at any four of ten possible transmission speeds. The ten speeds are: 45.5; 50; 75; 110; 134.5; 150; 200; 300; 600; and 1200 bits per second. This adjustment may be made for each of the four transmission lines attached to the line controller.

c. Adjustments made by programming

Although the transmission speed capability of the line controller is set at the time of its installation and may not be changed by either the programmer or operator, the MLC104 also controls a number of other functions which may be changed under programming control. These may be considered to be in two groups: those which apply equally to all transmission lines attached to a given controller; and those which may be different for each of the lines attached to the line controller.

The conditions which apply to all transmission lines at the controller are: whether transmission code is to be ISO 7 + 1 bit or Baudot 5 bit; whether one or two bits will be required to identify a stop; whether transmission will proceed with or without concern for parity; and whether odd or even parity is to be checked.

Conditions of transmission which may be set for each individual line attached to a line controller are: interrupts on the line will be accepted or ignored; interrupt will be generated when one of the standard end of message characters is recognized or not; and an interrupt will be generated when one of the special end of message characters is recognized or not. Standard and special end of message characters are described in Part II of this manual.

5. Line terminators.

Line terminators are those devices that form the interface between the datasets being used and the line controllers. Appendix B contains a list of line terminators that may be used with the MLC104.

Briefly, different types of line terminators are required for synchronous and for asynchronous transmission. Other differences among line terminators are based on whether transmission lines being used are telephonic or telegraphic, whether transmission is TWA or TWS type, and the transfer speed of the information in bits per second.

C. OPERATOR'S CONTROL PANEL

The following figure shows the arrangement of the operator's control panel.

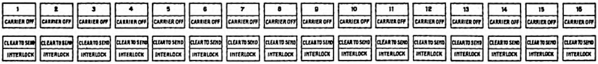


Figure 2. Operator's Control Panel.

Correspondence between the numbers on the indicator lamps and the addresses of the transmission lines is as follows:

LIGHT NUMBER	CONTROLLER LINE ADDRESS
1	0
2	2
3	4
4	6
5	8
6	A
7	C
8	E
9	1
10	3
11	5
12	7
13	9
14	B
15	D
16	F

Note that the 1, 2 ..... , 16 indicators are also On/Off switches, which are used to enable/disable each line.

The indicator lamps are the same for each transmission line and function as follows:

INDICATOR LAMP	SIGNIFICANCE
1 ... 16	Physical transmission line number which corresponds to the line controller transmission line address as shown in the previous list. When the indicator is lit it indicates that the line is disabled (press switch to enable).
CARRIER OFF	When this indicator is lit, the line is in receive mode and the carrier wave is absent.
INTERLOCK	When this indicator is lit, the dataset is connected and available to receive or transmit information.
CLEAR TO SEND	When this indicator is lit, information may be sent over the transmission line.

PART IV - FUNCTIONAL DESCRIPTION

This part of the manual describes the manner in which the MLC104 processes incoming and outgoing messages. Checking is considered to be part of the processing operation. For additional information regarding the programming of these processes, refer to Part V of this manual.

A. TRANSMIT MODE

1. Character and message transmission

Messages or information being transmitted are considered as moving from core store in the CPU out to the transmission lines. The MLC104 is capable of transmission in the 7 + 1 bit per character ISO code and the 5 bit per character Baudot code. Conversion between the transmission code and the store configuration (8 + 1 bit common to systems in the GE-100 Line) is performed in a manner described in Part II of this manual.

On each character received from the CPU for transmission, the MLC104 provides the required code compression. This converts each character from the 8 + 1 bit core store configuration to the required transmission configuration (ISO or Baudot).

2. Parity bit generation

During transfer of characters from the CPU to the line buffer, the MLC104 makes a parity check and provides a signal to the CPU in the case of any error. When generation of a parity bit is required, as in code compression to the ISO 7 + 1 bit code, the MLC104 generates an odd or even parity bit, as dictated by programming requirements.

3. Message length and manner of transmission

Three types of messages may be transmitted: those that are smaller than or equal to the buffer capacity of a transmission line; those that are larger than the buffer capacity of a transmission line; and those that are queued in the buffer with a response. Additional formatting details appear in Part II of this manual.

For messages which do not exceed the capacity of the transmission line buffer, the procedure is as follows:

When a Transmit Without Interrupt instruction is received, the message is transferred to the buffer of the transmission line addressed;

The message is transmitted over the specified transmission line;

The transmission line buffer is cleared of the message.

During these operations, the required parity checking and code compression is performed automatically. As transmission ends, the line controller assumes a status in which it is able to receive information.

For messages which exceed the capacity of the transmission line buffer, the message is sent in segmented fashion and the procedure is as follows:

When a Transmit With Interrupt instruction is received, the first segment of the message is transferred to the buffer of the transmission line addressed;

The segment of the message in the buffer is transmitted over the specified transmission line;

The transmission line buffer is cleared of the message segment;

As the transmission ends, an interrupt signal is sent to the CPU;

The CPU then transfers the next message segment to the buffer of the transmission line specified and the process repeats.

The last segment of the message is sent by means of a Transmit Without Interrupt instruction and processing of that segment is as for messages which do not exceed buffer capacity. During the processing of each message segment, the required parity checking and code compression are performed automatically.

For messages which are queued in the buffer with a response, the message must be of a size which will permit it to be stored with the response in the buffer of the same transmission line. This situation occurs in cases where the message transmitted must be retransmitted if the response from the terminal was negative. The processing procedure is as follows:

When a Transmit Without Erase instruction is received, the message is transferred to the buffer of the transmission line addressed;

The message is transmitted over the specified transmission line;

At the end of transmission, the message is retained in the buffer and the line controller goes into an idle state (ready to receive or transmit).

When the response is received, it is stored in the buffer with the original message transmitted.

During the processing of the transmitted message, the required parity checking and code compression are performed automatically.

Any message sent from the CPU to a transmission line buffer which is to be transmitted in ISO 7 + 1 bit code may exceed the number of character positions available in that line buffer. If the message is to be transmitted in Baudot 5 bit code, the length of the message may not exceed buffer capacity. Also, in the latter case, all figure-shift and letter-shift characters must be considered as occupying character positions in the buffer.

4. Break signals

When the MLC104 is in the process of transmitting information over any single transmission line, it may receive a Break signal from the dataset attached to that line. This signal, which is a minimum of 600 msec long, causes an immediate halt to further transmission, a zeroing of all logical states and indicators relative to transmission, and sends to the CPU an interrupt signal accompanied by an IGOL signal.
The interrupt and the IGOL signal may be reset by means of the Reset Break instruction. Status signals, such as IGOL, are described in greater detail in Part V

B. RECEIVE MODE

1. Receive instructions

The transfer of a message from a transmission line buffer to the CPU is accomplished by means of two different instructions: Receive; and Receive Queued Message.

In execution of the Receive instruction the contents of a transmission line buffer are transferred to the CPU, without erasing the message from the buffer. During the processing of this message, the required parity bit generation and code expansion are performed automatically.

In execution of the Receive Queued Message instruction the message received in response to a previous transmission is transferred to the CPU. This instruction must always be preceded by a Receive instruction.

With either the Receive or Received Queued Message instruction, the message transferred to the CPU must be declared equal to or greater in length than the capacity of a transmission line buffer.

The end of a message is signalled by any of a number of special or standard end of message characters. These are described in Part II of this manual.

2. Break signals

The MLC104 may transmit, over any line receving information to be transferred tl the CPU, a Break signal of a 300 msec duration by means of a Send Break instruction. The Break signal will be sent over the transmission line with a variable delay of approximately 0 to 300 msec. The Break signal causes an immediate suspension in the receiving of further information.

C. INTERRUPTS

1. General

There are various conditions which may cause an interrupt signal to be sent to the CPU. As all interrupts are logically ORed, any single interrupt signal from any source may cause the interrupt status signal, INES, to be sent to the CPU. INES and other status signals are described in Appendix E in this manual.

Three different classes of interrupt are recognized: interrupts on a transmission line to which no dataset is connected; interrupts on a line which is transmitting information; and interrupts on a line which is receiving information. Each category is discussed separately in the following paragraphs.

2. Interrupts on an open transmission line

An open transmission line is one to which no dataset is connected. In this case, an interrupt is sent to the CPU. This situation will not unconditionally cause an interrupt to be sent to the CPU as the Ring interrupt may be disabled. If disabled, the Ring interrupt may be enabled again by execution of the Enable Ring Interrupt instruction. The means of programming this instruction are described in Part V of this manual.

After execution of a General Reset instruction (for programming information, see Part V), all transmission lines are disabled.

3. Interrupts while transmitting

While information is being transmitted from the CPU to a dataset, two types of interrupt may occur: when the last character of a message has been transferred by means of a Transmit With Interrupt instruction (see Part V for programming information); or when a Break signal is received during transmission. Break signals while transmitting are described in section IV A of this manual.

4. Interrupts while receiving

There are four potential causes of interrupts which may occur while information is being received from datasets. These are described in following paragraphs.

An interrupt is transmitted whenever an overflow condition occurs at any line buffer. That is, when an attempt is made to store information in the 255th character position of the buffer.

An interrupt is transmitted whenever any of the following ISO characters is received:

ISO CHARACTER	7 BIT BINARY CONFIGURATION
ACK	0000110
NACK	0010101
ETB	0010111
ETX	0000011
ENQ	0000101
EOT	0000100

When one of these characters is immediately followed by another control character, the interrupt will occur at the end of reception of the second character. Thus, the interrupt will occur after the receipt of the BCC control character.

An interrupt occurs whenever a special end of message character is received over a line for which it has been defined as special. Special end of message characters are described in section II C of this manual.

An interrupt occurs when an alert level is reached in loading the buffer. The alert level is reached when 124 characters more are needed to fill up the buffer.

Of the four interrupt conditions described, the latter three may be implemented, in any combination, under program control.

D. CHECKING OPERATIONS

1. General

Checking operations in the MLC104 are of two basic types: automatic and programmed. The former set include those that are performed automatically, by the hardware; the latter set include those that are programmed. Although it is true that the type of parity check may be programmed (as for example whether odd or even parity is being checked) the check itself is performed automatically. A third type of checking also exists, but this is essentially external to the MLC104.
That is the checking performed by service personnel for malfunctions of the equipment. Each type of checking is described in following paragraphs.

2. Checking parity

Parity is checked automatically by the MLC104 during all transfers of information. Parity information is also provided on an as-required basis during the code expansion or compression process. That is the conversion to or from the 8 + 1 bit GE-100 Linestore configuration and the ISO 7 + 1 bit or Baudot 5 bit code used in actual transmission. This expansion and compression process is described in Part II of this manual.

Another means of parity checking is provided by the Block Check Character, BCC, which accompanies message units and is used in longitudinal parity checks of the entire unit. This character is described in greater detail in Part II of this manual.

3. Checking commands

Diagnostic tests of the line controller are performed with reference to the contents of the diagnostic register. This register is loaded by means of the Set Diagnostic Mode instruction. Programming of this instruction is described in Part V of this manual.

4. Checking malfunctions

Diagnostic tests of the line controller are performed with no transmission lines connected. Various operating conditions are simulated and the presence or absence of signals at appropriate locations is noted.

The diagnostics register has seven bit positions. If the content of any of these bit positions is 1, the appropriate test is not made; if the content is 0, the conditions simulated are as in the following list:

BIT POSITION	ACTIVITY
2^0	A Clear To Send signal is simulated as coming from the dataset interface.
2^1	Initiates a looping of characters at diverse levels at: the TA register; line buffer register; and character serialization and parallelization register. These are exclusively hardware registers and are not available for reference by the programmer or operator.
2^2	Simulates a line speed different from any of the ten allowed.

BIT POSITION	ACTIVITY
2^3	Simulates the reception of a Break signal.
2^4	Removes the FINE status signal from the controller. This permits reading character positions 254, 255, 511, and 512 in store.
2^5	Forces an error check on information received from the CPU. This serves as a test on internal checking operations.
2^6	Restricts the scanning of transmission lines to one transmission line.

The diagnostic register can be loaded by means of the Set Diagnostic Mode instruction (see part V).

PART V - PROGRAMMING

This part of the manual describes the machine language instructions which are provided for the programming of the MLC104. It is intended primarily for programmers.

A. GENERAL

1. Software

Manipulation of the information processed is the responsibility of the operating system in use. BIOS (Basic Input/Output System) is the part of the operating system which processes physical information; EIOS (Extended Input/Output System) is the part which processes logical information.

Normally no special routines for the use of the MLC104 need be written by the programmer; standard subroutines exist in the subroutine library of the operating system.
However, should a special subroutine be required for a special purpose, it must be coded by the programmer. The following paragraphs and sections describe the instructions themselves and indicate the manner in which coding may be done.

2. Format of I/O instructions

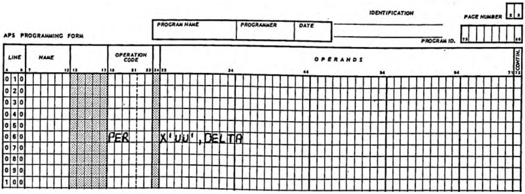
All data and instructions to the subsystem are issued by the CPU and sent, in the appropriate format, to the proper MLC104 subsystem and transmission line. Data and status signals are sent by the MLC104 to the CPU. The manner in which commands are sent to the MLC104, or more generally to any subsystem, is described in the appropriate Reference Manual. The present manual contains a brief summary of the Call Peripheral (PER) and Call Peripheral Indirect (PERI) instructions as an aid in explaining the functioning of the MLC104 subsystem.

The PER instruction is used in all GE-100 Line systems; the PERI instruction is used only with EDOS (Extended Disc Operating System) or ETOS (Extended Tape Operating System). The difference between the two instructions is as follows:

In the PER instruction, the line number or address to be used is named directly;

In the PERI instruction, the line number or address is retained in a fixed position in core store, and reference in the instruction is made to that location.

The PER instruction is coded on the APS programming sheet in the following manner:



APS PROGRAMMING FORM

PROGRAM NAME | PROGRAMMER | DATE

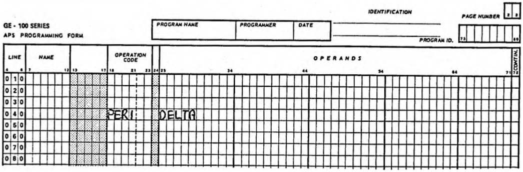
IDENTIFICATION

PAGE NUMBER 2 3

PROGRAM ID. 73 80

LINE 4 6	NAME 7 12	13 17	OPERATION CODE 18 21 23	24	OPERANDS 25 34 44 54 64 71	CONTIN. 72
010						
020						
030						
040						
050						
060			PER		X'UU',DELTA	
070						
080						
090						
100						

The PERI instruction is coded in the following manner:



GE - 100 SERIES
APS PROGRAMMING FORM

PROGRAM NAME | PROGRAMMER | DATE | IDENTIFICATION | PAGE NUMBER | PROGRAM ID.

LINE	NAME		OPERATION CODE	OPERANDS	CONTIN.
010					
020					
030					
040			PERI	DELTA	
050					
060					
070					
080					

The symbols used in coding have the following significance:

DELTA	Symbolic name of the field in core store which contains the parameter list for the peripheral operation to be executed
uu	Represents, in hexadecimal, the name of the line to be taken into account.

The configuration of the uu field varies depending on the connector used, if an MPA (Multiple Peripheral Adapter) is used or not, etc.
This field may be as follows:

Connector 3, no MPA uu = 00	(only one controller) (hexadecimal)
Connector 4, no MPA uu = 40	(only one controller) (hexadecimal)
Connector 3, one MPA uu = 00 to 30	(two to four controllers) (hexadecimal)
Connector 4, one MPA uu = 40 to 70	(two to four controllers) (hexadecimal)

B. INPUT/OUTPUT INSTRUCTIONS

The I/O instructions used in communicating with the MLC104 have the following configurations:

Data transfer

$$\text{FU }\underbrace{\text{DELTA}}_{\hookrightarrow\ \text{ZX}L_1L_2I_3I_4}$$

Peripheral unit control

$$\text{FU }\underbrace{\text{DELTA}}_{\hookrightarrow\ \text{ZX}}$$

Peripheral availability test

$$\text{FU }\underbrace{\text{DELTA}}_{\hookrightarrow\ \text{ZX}}$$

Store channel 3 conditions

$$\text{FU }\underbrace{\text{DELTA}}_{\hookrightarrow\ \text{ZX}}$$

Peripheral status test

$$\text{FU }\underbrace{\text{DELTA}}_{\hookrightarrow\ \text{ZX}}$$

The significance of each of these symbols is explained in the following paragraphs.

F indicates if the instruction is of the PER or PERI type

U is the line number or address (the uu field).

L_1L_2 represents the length, in characters, of the field to be transferred.

I_3I_4 represents the store address to or from which the data is to be transferred.

The character in the Z position is interpreted by the CPU as specifying the mode of execution of the instruction, which is identified by the X character position. For example: if instruction execution is to be immediate or not;if information is to be transferred by ascending or descending addresses; etc.

1. Value of characters Z and X

a. Data Transfer Commands

The value of Z is always hexadecimal '50' except for input instructions (i.e. Read Received Message and Read Queued Message) for which the value of Z will be hexadecimal '10'

Instruction	X (hexedecimal)
Set diagnostic mode	0E
Read received message	40
Transmit without erase	42
Transmit without interrupt	43
Transmit with interrupt	46
Set options register	4A
Read queued message	60
Set special end character	A4

NOTE: All the commands keep the controller busy.

A detailed description follows for each command

1) Transmit with interrupt.

   This instruction effects the transfer of a message from the CPU to the buffer of the line addressed, indicating the end of transmission by means of an interrupt signal. It also identifies a line as being in transmission, initiating a Request To Send loop at the dataset interface. The message is transmitted as soon as a Clear To Send signal is received from the dataset. At the end of transmission an interrupt is sent to the CPU. The line is maintained in a state ready to transmit and a Request To Send loop is still present at the dataset interface. The buffer is cleared as the message is transmitted. The status signals issued to the CPU as a result of the execution of this instruction include: CAPE; ERCA; and PE00.

2) Transmit without interrupt.

   This instruction effects the transfer of a message from the CPU to the buffer of the line addressed without signalling the CPU regarding the end of transmission. It also identifies the line as being in transmission, initiating a Request To Send loop at the dataset interface. The message is transmitted as soon as a Clear To Send signal is received from the dataset. At the end of transmission, the line passes into an idle state (ready to receive or transmit). The buffer is cleared as the message is transmitted. The status signals issued to the CPU as a result of the execution of this instruction include: CAPE; ERCA; and PE00.

3) Transmit without erase.

This instruction effects the transfer of a message from the CPU to the buffer of the line addressed without signalling the CPU regarding the end of transmission and without clearing the buffer after transmission. It also identifies the line as being in transmission, initiating a Request To Send loop at the dataset interface. The message is transmitted as soon as a Clear To Send signal is received from the dataset. At the end of transmission, the line passes into an idle state (ready to receive or transmit). The status signals issued to the CPU as a result of the execution of this instruction include: CAPE; ERCA; and PE00.

4) Read received message

This instruction effects the transfer of a message from the buffer of the line addressed to the CPU. The characters in the buffer at the time the instruction is executed are transferred. After a character is transferred, the line assumes a configuration that permits it to receive additional information; if characters to be transferred remain in the buffer, the line leaves the receive mode as soon as it may transmit another character to the CPU. The length of the message transferred may exceed buffer capacity because the end of the transfer is signalled by the controller. The status signals issued to the CPU as a result of the execution of this instruction include: CAPE; ERCA; SEGE; and PE00.

5) Read queued message.

This instruction effects the transfer of a queued message from the buffer of the line addressed to the CPU without clearing the buffer after transmission. This instruction must always follow a receive instruction; the length of the message transferred may exceed buffer capacity because the end of the transfer is signalled by the controller. The status signals issued to the CPU as a result of the execution of this instruction include: CAPE; ERCA; SEGE; PE00.

6) Set special end character.

This instruction references to a character that is stored in the last octet reserved for information from the line addressed. In execution, this character is compared to each character arriving over the line; an equal comparison causes an interrupt signal to be issued. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; ERCA; and PE00.

7) Set options register.

This instruction references to a character which is stored in the options register of the line addressed. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; ERCA; and PE00.

8) Set diagnostic mode.

This instruction references to a character which is stored in the diagnostic mode register. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; ERCA; and PE00.

b. Peripheral unit control

The value of Z is always exadecimal '80'.

Instruction	X (hexadecimal)
Enable ring interrupt	0C
Connect dataset	11
Disconnect dataset	14
Send break signal	44
Reset break	47
Divide buffer	A3
General reset	C0

NOTE: The "Reset break" command keeps the controller busy without data transfer. All other control commands leave the controller in an "available" state.

A detailed description follows for each command.

1) Divide buffer.

   This instruction provides for an increase in the size of transmission line buffers to a maximum of 510 characters each. The controller is not in a busy state during execution of this instruction. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

2) Enable ring interrupt.

   This instruction permits a ring interrupt to be sent at an appropriate time by a specific dataset to the CPU. The controller is not in a busy state during execution of this instruction. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

3) Disconnect dataset.

   This instruction removes the Data Terminal Ready Signal from the dataset interface. In effect, this disconnects the dataset from the system. No ring interrupt may be received at the CPU from this dataset after execution of this instruction. The controller is not in a busy state during execution of this instruction. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

4) Connect dataset.

   This instruction initiates a Data Terminal Ready signal at the dataset interface. This, in effect, connects the dataset to the system. The controller is not in a busy state during execution of this instruction. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

5) Send break.

This instruction causes the Break signal to be transmitted over the appropriate line. The controller is not in a busy state during execution of this instruction. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

6) General reset.

This instruction has the same function as the CLEAR control at the CPU console (the buffer is not cleared). The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; and ERCA.

7) Reset break.

This instruction returns the transmission line to the same state in which it was prior to the occurrence of the Break signal. It also clears the line's buffer. During the execution of this instruction, the controller is in a busy state during the time the buffer is being cleared. This is approximately 2.7 msec for a 256 character position buffer. The status signals issued to the CPU as the result of the execution of this instruction include: CAPE; ERCA; and PE00.

c. Peripheral availability test

There is only one instruction in this set. It is used to check the availability of the devices along a specific transmission line before a new operation is initiated.

The value of Z in hexadecimal 'E0'
The value of X in hexadecimal '00'

d. Store channel 3 conditions

There is only one instruction in this set. It is used to store qualitative results and auxiliary information generated by the last data transfer operation on channel 3.

The value of Z in hexadecimal 'CC'
The value of X in hexadecimal '40'.

e. Peripheral status test

These commands can be used to test the following conditions (status) of the subsystem. The value of Z is always exadecimal 'C0'.

Signal	X (hexadecimal)
PE00 (Subsystem available)	01
SEGE (Input parity error)	03
FISE (Interrupting line)	05
MAPE (Line in receive mode)	10
MARE (Disabled line)	14
MATE (Dataset connected)	1A
INES (Interrupt)	1C
CAPE (Command error)	1E
IGOL (Break/overflow)	22
ERCA (Output parity error)	40
FINE (End of transfer)	see Note

Note

The signal FINE cannot be tested by means of a PER/PERI instruction, but only by using a JC instruction to test if UF/OF and ZE/NZ are 11 (end of transfer reached) or not.

A detailed description follows for each status signal.

1) PE00 Subsystem available

When this signal is issued, it indicates that all transmission lines connected to the controller are available. The lines are not available in either of the two following cases:

During the execution of a Reset Break command which also has the function of clearing the buffer of the transmission line addressed;

At the end of an incoming or outgoing data transfer when the transmission line is scanned. This period is approximately 315 µsec long.

This signal may be issued in connection with the following commands: Transmit With Interrupt; Transmit Without Interrupt; Transmit Without Erase; Receive Queued Message; Set Special End Character; Set Options Register; Set Diagnostic Mode; Reset Break; and Read Received Message.

2) IGOL Break/Overflow

This signal is present under the following circumstances:

The line addressed has received a Break signal while in the process of transmitting.

The message received on the line addressed has reached the last buffer position. Further reception is blocked to prevent the first part of the message which has already been stored from being destroyed.

This signal is reset either by a Reset Break command (in the case of Break) or by any receive command (in the case of Overflow)

3) CAPE Command error

This signal is issued when any of the following conditions occurs:

A command is issued for a transmission line which is disabled. The MARE signal is also present.

A command is issued for a transmission line which is presently unavailable. The PE00 signal is absent.

The command received is not recognized as belonging to the set of commands which may be executed by the MLC104.

A transverse parity error exists in the command.

A request has been made to transmit data along a transmission line which is receiving information or to receive data along a line which is transmitting.

During the transfer of characters from the CPU to a line buffer, the contents of bit position 2^5 were found to be different from those of bit position 2^7.

A General reset or CPU reset signal is present.

This signal may be issued in connection with the following commands: Transmit With Interrupt; Transmit Without Interrupt; Transmit Without Erase; Receive; Receive Queued Message; Set Special End Character; Set Options Register; Set Diagnostic Mode; Divide Buffer; Enable Ring Interrupt; Disconnect Dataset; Connect Dataset; Send Break, General Reset; and Reset Break.

4) ERCA Output parity error

This signal is issued when a transverse parity error is discovered during a transfer of commands or data.

This signal may be issued in connection with the following commands: Transmit With Interrupt; Transmit Without Interrupt; Transmit Without Erase; Receive; Receive Queued Message; Set Special End Character; Set Options Register; Set Diagnostic Mode; Divide Buffer; Enable Ring Interrupt; Disconnect Dataset; Connect Dataset; Send Break; General Reset; and Reset Break.

5) SEGE Input parity error

This signal is issued when the message being transferred is found to have a transverse parity error.

This signal may be issued in connection with the following commands: Receive; and Receive Queued Message.

6) MARE Disabled Line

This signal is issued when the console switch for the line addressed is in the "disabled" position.

7) INES Interrupt

This signal is issued whenever at least one transmission line has an interrupt level signal.
This signal is reset when one of the following commands is sent to the interrupting line (1):

Transmit or Receive command
Reset Break
Enable or Disable A Transmission Line
Enable Ring Interrupt.

A General Reset command or a reset from CPU console, causes this signal to be reset on all interrupting lines at the same time.

8) MAPE Line in receive mode

This signal is present when the line addressed is receiving information. That is, when it has received at least one character and this character has not yet been requested by the CPU by means of a read command.

9) FINE End of transfer

This signal is present when either of the two following conditions exist:

In an information transfer initiated by a transmit command the last position of the transmission line's buffer has been accessed.

In an information transfer initiated by a receive command, the last character contained in the buffer has been transferred.

10) FISE Interrupting line

This signal is generated when the line addressed has an interrupt signal (INES) present.

11) MATE Dataset connected (dataset ready)

This signal is present when the dataset ready signal (positive level) is present at the dataset interface of the line addressed.

APPENDICES

A. PREREQUISITE AND RELATED READING

Codes	Title	Catalog Number	
		Code	Ref.
P-A/O	GE-120 Reference Manual	3917101H	32.20.002A
P-A/O	GE-130 Reference Manual	3918105Y	32.20.003A
R-A	EDOS Programmer's Manual, Vol. 1	3918117U	32.38.010A
R-A	EDOS Programmer's Manual, Vol. 2	3918124R	32.38.011A
R-O	EDOS Operator's Manual	3918119M	32.53.508A
R-A	MLC104 Subroutines	To be assigned	

Codes: P Prerequisite Reading
R Related Reading
A Analysts, Programmers
O Operators

B. LINE CONTROLLERS AND TERMINATORS

In this appendix are specified some functional characteristics of line controllers and line terminators that may be connected to the MLC104.

1. Line controllers

a. Line Controller Asynchronous LCA104.

This type LCA is used to control up to four transmission lines operating in the half-duplex asynchronous manner or two paired transmission lines operating in the full duplex asynchronous manner. Options that may be chosen under programming control include: interrupt generated upon recognition of standard or special end characters; overcoming of alert levels in regard to buffer filling; choice of using Baudot 5 bit or ISO 7 + 1 bit code for transmission and various types of parity checks.

2. Line terminators

a. Line Terminator Asynchronous LTA100.

This type LTA is used to make direct telegraphic line connection without the need for datasets. In this case the terminal does not need a dataset as this function is filled by a Telegraphic Adapter.

b. Line Terminator Asynchronous LTA101

This type LTA is used to connect the controller to datasets of the half or full duplex type for two-way alternate transmission. Datasets that may be used include the following: Bell 103; ARE; SELENIA; and others capable of transmission at up to 300 bits per second over private or switched transmission lines.

c. Line Terminator Asynchronous LTA103.

This type LTA is used to connect the controller to datasets of the half or full duplex type for two-way alternate transmission. Datasets that may be used include the following: ITT GH2002; Olivetti TD2200; Bell 202; and others capable of transmission at up to 1200 bits per second over private or switched transmission lines.

d. Line Terminator Asynchronous LTA105.

This type LTA is used to make direct connection to nearby terminals (up to 15 meters away), without datasets. In this case the terminal does not need a dataset as this function is filled by the LTA.

e. Line Terminator Asynchronous LTA111.

This type LTA is used to connect the controller to datasets of the full duplex type for two-way simultaneous transmission. Datasets that may be used include the following: Bell 103; ARE; SELENIA; and others capable of transmission at up to 300 bits per second over private or switched transmission lines.

f. Line Terminator Asynchronous LTA112.

This type LTA is used to connect the controller to datasets of the full duplex type for two-way simultaneous transmission. Datasets that may be used include the following: ITT CH2002; Olivetti TD2200; and others capable of transmission at up to 1200 bits per second over private transmission lines.

C. ISO (USASCII) CODE

This appendix lists the 8-bit expanded equivalent of each of the 7-bit ISO (USASCII) symbols and control characters used in transmission lines. The manner in which expansion and compression between the 7 + 1 bit ISO code and the 8 + 1 bit expanded code is performed is described in Part IV of this manual.

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
NULL	0000 0000	00
SOH	0000 0001	01
STX	0000 0010	02
ETX	0000 0011	03
EOT	0000 0100	04
ENQ	0000 0101	05
ACK	0000 0110	06
BELL	0000 0111	07
BSP	0000 1000	08
HT	0000 1001	09
LF	0000 1010	0A
VT	0000 1011	0B
FFD	0000 1100	0C
CR	0000 1101	0D
SO	0000 1110	0E
SI	0000 1111	0F

SYMBOL	EXPANDED CODE BINARY)	EXPANDED CODE (HEX)
DLE	0001 0000	10
DC1	0001 0001	11
DC2	0001 0010	12
DC3	0001 0011	13
CC4	0001 0100	14
NAK	0001 0101	15
SYN	0001 0110	16
ETB	0001 0111	17
CAN	0001 1000	18
EM	0001 1001	19
SUB	0001 1010	1A
ESC	0001 1011	1B
FS	0001 1100	1C
GS	0001 1101	1D
RS	0001 1110	1E
US	0001 1111	1F
SP	0100 0000	40
EXP	0100 0001	41
"	0100 0010	42
#	0100 0011	43
$	0100 0100	44

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
%	0100 0101	45
&	0100 0110	46
'	0100 0111	47
(	0100 1000	48
)	0100 1001	49
*	0100 1010	4A
+	0100 1011	4B
,	0100 1100	4C
-	0100 1101	4D
.	0100 1110	4E
/	0100 1111	4F
0	0101 0000	50
1	0101 0001	51
2	0101 0010	52
3	0101 0011	53
4	0101 0100	54
5	0101 0101	55
6	0101 0110	56
7	0101 0111	57
8	0101 1000	58
9	0101 1001	59

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
:	0101 1010	5A
;	0101 1011	5B
LTN	0101 1100	5C
=	0101 1101	5D
GTN	0101 1110	5E
?	0101 1111	5F
@	1010 0000	A0
A	1010 0001	A1
B	1010 0010	A2
C	1010 0011	A3
D	1010 0100	A4
E	1010 0101	A5
F	1010 0110	A6
G	1010 0111	A7
H	1010 1000	A8
I	1010 1001	A9
J	1010 1010	AA
K	1010 1011	AB
L	1010 1100	AC
M	1010 1101	AD
N	1010 1110	AE

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
O	1010 1111	AF
P	1011 0000	B0
Q	1011 0001	B1
R	1011 0010	B2
S	1011 0011	B3
T	1011 0100	B4
U	1011 0101	B5
V	1011 0110	B6
W	1011 0111	B7
X	1011 1000	B8
Y	1011 1001	B9
Z	1011 1010	BA
LBK	1011 1011	BB
RSL	1011 1100	BC
RBK	1011 1101	BD
CFX	1011 1110	BE
___	1011 1111	BF
GRA	1110 0000	E0
a	1110 0001	E1
b	1110 0010	E2
c	1110 0011	E3

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
d	1110 0100	E4
e	1110 0101	E5
f	1110 0110	E6
g	1110 0111	E7
h	1110 1000	E8
i	1110 1001	E9
j	1110 1010	EA
k	1110 1011	EB
l	1110 1100	EC
m	1110 1101	ED
n	1110 1110	EE
o	1110 1111	EF
p	1111 0000	F0
q	1111 0001	F1
r	1111 0010	F2
s	1111 0011	F3
t	1111 0100	F4
u	1111 0101	F5
v	1111 0110	F6
w	1111 0111	F7
x	1111 1000	F8

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
y	1111 1001	F9
z	1111 1010	FA
LBR	1111 1011	FB
VTL	1111 1100	FC
RBR	1111 1101	FD
TLD	1111 1110	FE
DEL	1111 1111	FF

D. TELEGRAPHIC (BAUDOT) CODE

This appendix lists the Telegraphic (Baudot) code symbols and their expanded 8-bit configuration equivalents. The means by which the expansion and compression are accomplished is described in Part IV of this manual.

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
A	0101 1000	58
B	0101 0011	53
C	0100 1110	4E
D	0101 0010	52
E	0101 0000	50
F	0101 0110	56
G	0100 1011	4B
H	0100 0101	45
I	0100 1100	4C
J	0101 1010	5A
K	0101 1110	5E
L	0100 1001	49
M	0100 0111	47
N	0100 0110	46
O	0100 0011	43
P	0100 1101	4D

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
Q	0101 1101	5D
R	0100 1010	4A
S	0101 0100	54
T	0100 0001	41
U	0101 1100	5C
V	0100 1111	4F
W	0101 1001	59
X	0101 0111	57
Y	0101 0101	55
Z	0101 0001	51
-	1011 1000	B8
?	1011 0011	B3
:	1010 1110	AE
(Who are you)	1011 0010	B2
3	1011 0000	B0
8	1010 1100	AC
(Bell)	1011 1010	BA
(	1011 1110	BE
)	1010 1001	A9
.	1010 0111	A7
,	1010 0110	A6

SYMBOL	EXPANDED CODE (BINARY)	EXPANDED CODE (HEX)
9	1010 0011	A3
0	1010 1101	AD
1	1011 1101	BD
4	1010 1010	AA
'	1011 0100	B4
5	1010 0001	A1
7	1011 1100	BC
=	1010 1111	AF
2	1011 1001	B9
/	1011 0111	B7
6	1011 0101	B5
+	1011 0001	B1
(Carriage return)	1010 0010	A2
(Line feed)	1010 1000	A8
(Letter-shift)	1011 1111	BF
(Figure-shift)	1011 1011	BB
(Space)	1010 0100	A4

E. PHYSICAL CHARACTERISTICS

The physical specifications of the MLC104 are as described in the following list:

Height:	44.3 in.	(1120 mm)
Width:	38.8 in.	(980 mm)
Depth:	27.7 in.	(700 mm)

Operating temperature limits: 50° to 100° F (10° to 38° C)

Humidity limits: 20 to 80 %

Power supplies:	220v (± 10%)	50 hz (± 5%)	3 phase ac
or	208v (± 10%)	60 hz (± 5%)	3 phase ac

Current for either is 2 amps per phase.

Heat dissipation: 190 Kcal/H

DOCUMENT REVIEW SHEET

TITLE: GE 100 Line – MLC104 Multi-Line Controller
CODE: 3911113 V / Rèf. 32.23.003 A

FROM:
Name :
Position:
Address:

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